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THE JOURNAL OF PERIODONTOLOGY is published to serve as the professional journal of periodontia; to keep dentists in touch with research being carried on in this field and related sciences; to stimulate greater interest in the supporting tissues of the teeth and their relation to oral and general health.

The Journal is the official organ of the American Academy of Periodontology and will contain, therefore, papers of scientific and clinical interest which are presented at the annual meetings of that society, as well as articles submitted direct to the Editor. Obviously opinions expressed do not necessarily represent those of the Editor or the American Academy of Periodontology.

1960 Annual Meeting

October 13, 14, 15, 1960

Mirimar Hotel, Santa Monica, Calif.

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Dr. Goldman is widely known for his many contributions to dental literature and dental programs in the field of periodontology. He has published over sixty articles in well-known dental journals and is author of a textbook, "Periodontia" with Dr. Cohen which is now in its fourth edition. He has also written a book entitled "Periodontal Therapy" with Drs. Schluger and Fox, and an "Introduction to Periodontia." He has contributed chapters in several other books and has edited an Atlas of Dental and Oral Pathology.

Dr. Goldman is a past President of the American Academy of Oral Pathology and was recently President of the American Board of Oral Pathology. He is also a Diplomate of the American Board of Periodontology and has served on its Board. In addition to his many activities he still finds time to conduct a private practice at 482 Beacon Street, Boston 15, Massachusetts. He resides at 45 Beverly Road, Chestnut Hill, Massachusetts.

THE JOURNAL OF PERIODONTOLOGY

JULY, NINETEEN HUNDRED SIXTY

Newer Concepts of Mucogingival Surgery*

by CLIFFORD OCHSENBEIN, D.D.S., *Austin, Texas*

MUCOGINGIVAL surgery is a relatively recent innovation in periodontal treatment. It is concerned with the problems of attached gingiva, alveolar mucosa and of the vestibular trough. The techniques of gingivectomy, gingivoplasty and osseous surgery make no provision for the management of alveolar mucosa as it relates to the attached gingiva.

One of the primary objectives of periodontal surgery is pocket elimination. Prior to the introduction of mucogingival surgery, the periodontist was forced to compromise in this objective when the base of the pocket extended close to the mucogingival line or beyond it into the alveolar mucosa. Other familiar problems were the shallow vestibular trough and aberrant insertions of frenii or muscle attachments into the marginal gingiva. The history, terminology and classification of mucogingival surgery have been adequately described in the literature.[1]

The purpose of this paper is to establish certain observations of tissue behavior as a result of our therapy and to suggest certain basic principles governing our methodology in relation to this behavior. This report is the result of observation of a considerable number of these alterations and an evaluation of success and failure as it relates to these principles.

Histologically the difference in attached gingiva and alveolar mucosa is of fundamental importance. Attached gingiva has heavy collagenous fiber bundles attaching the mucous membrane to the cementum and bone. The epithelium is hornified, the surface is normally stippled and there are no elastic fibers. Alveolar mucosa presents a smooth texture and is loosely bound to the underlying periosteum of the alveolar process. The lamina propria contains many elastic fibers and the surface of the alveolar mucosa is not hornified.[2] The attached gingiva is separated from the alveolar mucosa by a festooned line, the mucogingival junction. Attached gingiva is structurally designed for functional demands, while alveolar mucosa is a thin delicate tissue, loosely attached and not adaptable to the function of mastication.

*Presented before the Philadelphia Society of Periodontology, November 1959, and the Rocky Mountain Dental Seminar, Glenwood Springs, Colorado, December 1959.

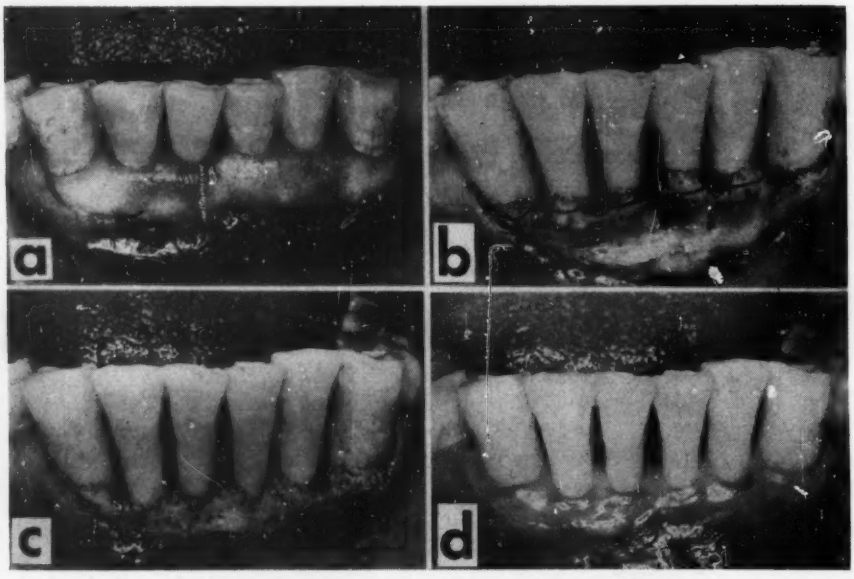

Fig. 1. 1a—A gingivectomy incision has been performed at the mucogingival junction. 1b—A modified flap detached the alveolar mucosa and periosteum from the bone. Bone deformities are exposed. 1c—Osseous surgery was used to create physiologic bone contours. 1d—Postoperative result. The width of the new zone of attached gingiva and the width of marginal bone exposed are generally equal.

The problem of insufficient attached gingiva exists where pockets approach or traverse the mucogingival junction or line. If the pocket terminates 1 or 2 mm. coronal to the mucogingival line, a surgical procedure designed for pocket elimination would leave only a narrow band of attached gingiva which usually could not withstand the physiologic forces of mastication. The narrow band of attached gingiva, once having a knife-edged margin soon develops into a thickened fibrotic roll that retains food. If the pocket terminates at the mucogingival line, or apical to it, surgical reduction of the pocket would remove all of the attached gingiva and the gingival margin would then be alveolar mucosa. A margin of alveolar mucosa will heal slowly, soon retract and permit food retention with further complications.

The problem of an inadequate zone of attached gingiva may be associated with adequate vestibular depth or shallow inadequate depth after marginal surgery has been performed. The shallow inadequate vestibular trough becomes a problem when it is associated with a narrow zone of attached gingiva.

The gingival replacement procedure was developed by Fox, for the purpose of creating a new zone of attached gingiva.[3] Schluger developed the vestibular trough extension, which is indicated when extension of vestibular depth is required *in addition* to the replacement of the zone of attached gingiva.[4]

A number of variations have been used of these two basic procedures. One of these is the repositioning of the existing attached gingiva.[5] This procedure consists of a sliding flap of properly prepared attached gingiva in an apical direction and its fixation in its new position. Since the basic objective for all mucogingival procedures are the same, this variation as well as several others will be omitted in this report.

A TECHNIQUE OF GINGIVAL REPLACEMENT

Gingival replacement means that all of the attached gingiva has been removed

during surgery and its replacement with a wide, new zone of attached gingiva is the therapeutic goal. It is performed in the presence of adequate vestibular depth.

Gingival replacement can be applied equally well to one tooth or an entire quadrant. The gingival replacement procedure with an associated frenum problem is demonstrated in Fig. *1a*. Pocket depth was measured and recorded on the gingiva. A routine gingivectomy incision was made at the base of the periodontal pockets which were at the mucogingival junction and therefore all of the attached gingiva was removed. The incision in the midline was about 1 mm. coronal to a broad based frenum attachment, Fig. *1b*. A modified flap was elevated which detached both alveolar mucosa and periosteum from the bone, without the aid of vertical incisions. This is customary procedure in gaining access for osseous surgery. In this particular case the procedure also relieved the frenum attachment. Note the bone deformities with higher levels of bone in marginal areas than in the interproximal areas. Osteoplasty and osteoectomy were used to create a physiologic pattern of bone architecture, Fig. *1c*.[6,7,8] The flap was reflected so that 3 to 4 mm. of marginal bone was exposed. Distention of the lip did not appreciably alter the position of the margin of the flap in relation to the margin of the bone. The 3 to 4 mm. of exposed bone was fairly constant. Observe the width of the exposed bone and then examine the postoperative result in Fig. *1d*. The width of the bone denuded and the new zone of attached gingiva are generally equal.

Another clinical case is seen in Fig. *2a*. A gingivectomy incision was performed, extending distally from the cuspid to the second molar. The zone of attached gingiva was removed by this procedure, but the vestibular trough depth was adequate. A modified flap was then reflected and the marginal bone exposed, Fig. *2b*. Osseous reshaping procedures were applied for the correction of the blunted interdental bony crests, Fig. *2c*.[9,10,11] Approximately 2 mm. of the retracted tissue was removed with shears, exposing a wider band of bone. Dressing was applied directly over the bone and a five day postoperative result is seen in Fig. *2d*. At this stage of healing, granulation tissue has formed in the interdental areas and in some extent in the marginal areas. Fig. *2e* is an eighteen day postoperative view. A narrow band of exposed bone of variable width is seen running parallel and adjacent to the well healed edge of the alveolar mucosa flap. The cut edge of alveolar mucosa healed about the eighth day but has not exhibited any coronal growth over the band of exposed bone. Excess granulation tissue was present around the first molar, which was easily removed with shears. On the twenty-third postoperative day of healing, only a small island of denuded bone remains in the second bicuspid area, Fig. *2f*. The final postoperative result, Fig. *2g*, reveals a new adequate zone of attached gingiva. New attached gingiva now exists where bone was denuded. Compare the width of this new zone of tissue with that of the exposed bone in Fig. *2c*.

From these cases, which are merely two of a series of more than fifty, it may be inferred that the resultant apical projection of the zone of attached gingiva is limited by the width of the bone exposed. Further corroborating this observation is the finding that it is impossible with sharp dissection, or any other means at our command, to separate attached gingiva from its underlying periosteum. Again, it may be inferred, that the attached gingiva is so inextricably bound to the underlying periosteum as to constitute a single "tissue complex."

Since there is a direct relationship between the width of the band of denuded bone and the new zone of attached gingiva, it becomes obvious that the flap must be controlled and not be permitted to slip coronally. Many therapists observe the relationship of the flap to the bone when the cheeks and lips are stretched for good vision of the surgical area. This

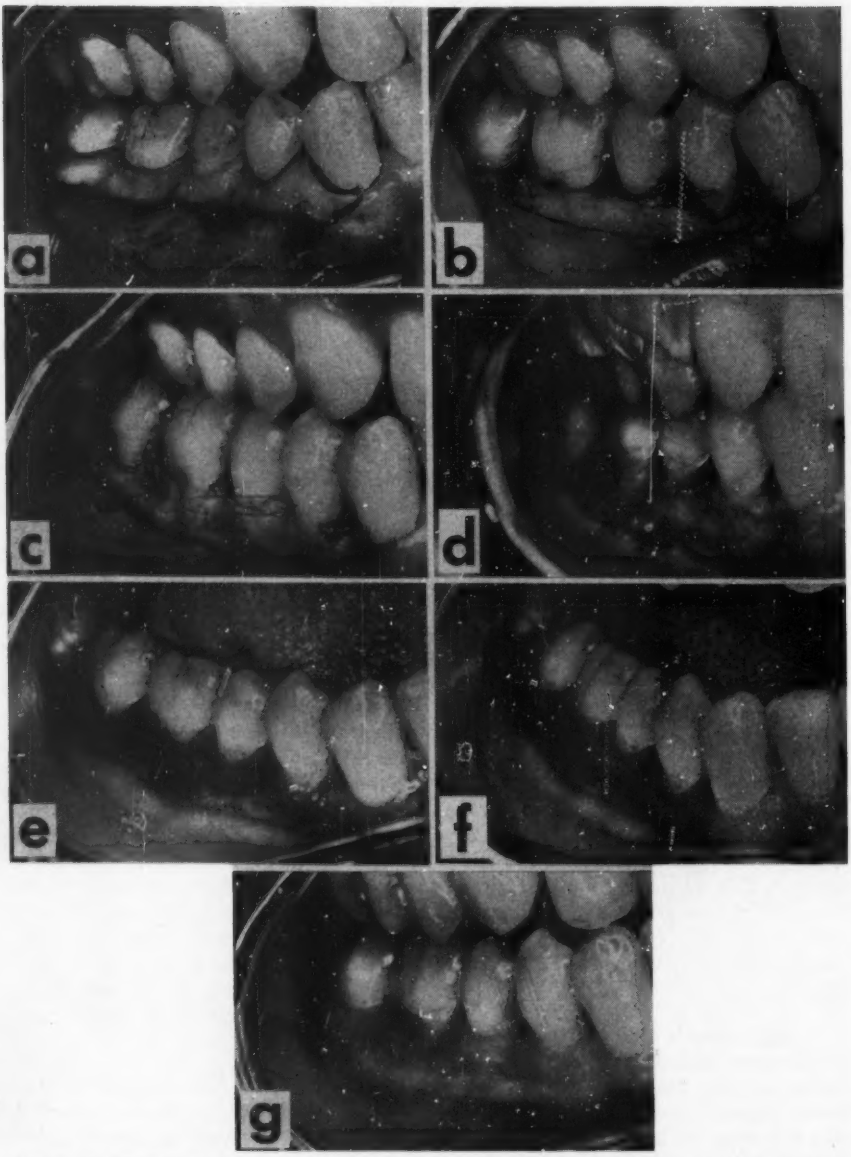

Fig. 2. 2a—Gingivectomy incision performed. All attached gingiva was removed by the procedure. Vestibular depth was adequate. 2b—Modified flap performed. 2c—Osseous surgery was employed for necessary bony correction. 2d—Five day postoperative result. 2e—Eighteen day postoperative result. 2f—Twenty-third day postoperative result. 2g—Final postoperative result. New attached gingiva is present where bone was denuded.

moves the flap apically and gives a false impression of its relaxed position and relationship to the facial bony plate. Coronal shifting of the soft tissue flap undoubtedly accounts for many of the disappointments in the postoperative result where a very narrow band of attached gingiva results from the therapist's efforts.

The pattern of healing that occurs when attached gingiva forms over the exposed marginal bone reveals some interesting information. The first evidence of new attached gingiva is the formation of clumps of granulation tissue at the cervical area of the tooth. Eventually, the clumps coalesce to form a continuous ring of granulation tissue encircling the tooth. As healing progresses the cervical granulation tissue migrates apically over the denuded bone. There is rarely any evidence of coronal proliferation from the marginal or cut edge of alveolar mucosa. The bone adjacent to this edge of tissue is the last to be covered by the cervical downgrowth of granulation tissue. Therefore, the new zone of attached gingiva develops from the apical extension of the cervical granulation tissue and not from coronal proliferation of the alveolar mucosa. The width of the new zone of attached gingiva will be dictated by the amount of marginal bone left exposed.

The width of the zone of attached gingiva that may be considered adequate after periodontal surgery has not been clinically established. It will undoubtedly vary in individual cases. The location of the zone of attached gingiva and its relation to the various anatomical structures along with the excellence of homecare and other factors will be important considerations. In many cases a narrow 1 to 2 mm. zone of attached gingiva may prove to be sufficient after periodontal therapy when a favorable environment is present. However, it has been observed by therapists performing extensive periodontal prosthetic procedures, that a narrow 1 to 2 mm. zone of attached gingiva is often inadequate when the involved teeth are the recipients of full cast or veneer crowns.[12, 13, 14]

DOUBLE FLAP PROCEDURE FOR EXTENSION OF THE VESTIBULE COMBINED WITH GINGIVAL REPLACEMENT

A modification of Schluger's procedure will be presented that will satisfy the basic objectives of extending vestibular depth and gingival replacement. The merit of this modification lies in its ability to reduce postoperative pain and shorten the healing period. Fig. *3*, is a diagramatic representation of the technical procedures, and Fig. *4*, demonstrates their clinical application. A routine gingivectomy was performed from the cuspid to the second molar. Bone deformities were present in the molar areas and access for therapy was gained by reflecting a modified flap. Alveolar mucosa and periosteum were drawn apically, exposing craters and a buccal bifurcation involvement of the first molar, Fig. *4a*. Osseous reshaping procedures were used to establish physiologic bone contours, Fig. *4b*. The attached gingiva has been removed in the molar and second premolar areas. The vestibular trough, although relatively shallow, was considered to be adequate. However, since the frenum attachment between the cuspid and first premolar has been frequently traumatized by the toothbrush and therefore in need of correction, the vestibular trough was deepened concomitantly. An oblique vertical incision was made into the alveolar mucosa mesial to the first premolar, Fig. *4c*. Light pressure was applied in making the incision, being careful not to incise the periosteum. Tissue retracts both anteriorly and posteriorly from such an incision and separation of the alveolar mucosa from the periosteum is begun from this retracted edge. The separation of the alveolar mucosa from the periosteum is extended distally to the second molar and apically beyond the existing vestibular trough in a peeling fashion. In Fig. *4d*, the surgery has been completed and the area is ready for the dressing to be applied.

The requirements for gingival replacement and extension of the vestibular trough have been established. The band of exposed marginal bone will produce a similar

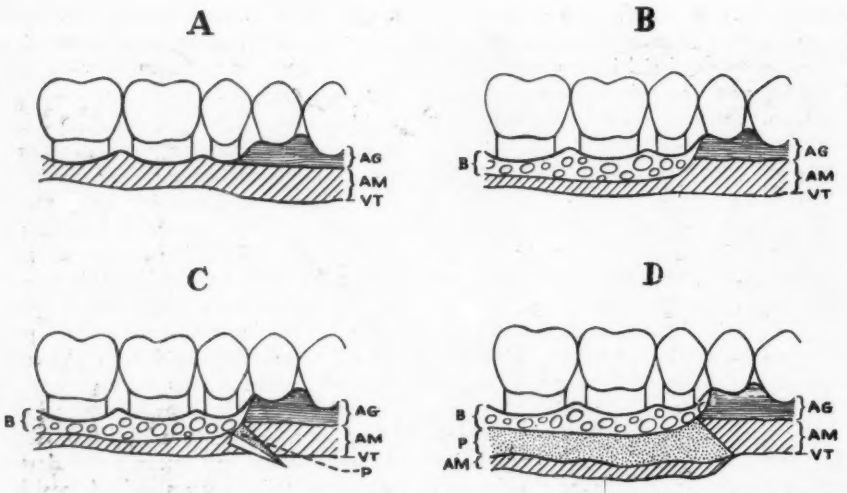

Fig. 3. The Double Flap Procedure. AG—Attached gingiva, AM—Alveolar mucosa, VT—Vestibular trough, B—Bone, P—Periosteum. A.—The gingivectomy eliminated the periodontal pockets associated with the molars and the second premolar. All the attached gingiva was removed in the procedure. After removal of marginal tissue, vestibular depth is inadequate. A method for extension of the vestibule is described in C and D. B.—A modified flap has been elevated and marginal bone exposed for osseous surgery, if indicated. C.—An oblique vertical incision has been made at the anterior extension of the flapped tissue; the incision does not penetrate the periosteum. Elastic fibers in the alveolar mucosa will cause the tissue on either side of the incision to retract. Separation of alveolar mucosa and periosteum begins from this oblique vertical incision. D.—The alveolar mucosa is peeled from the periosteum. Any remnants of attached gingiva should be removed prior to the procedure, because it makes separation difficult. Separation of the tissues was performed as far apically as necessary for the extension of the vestibular trough. Periosteum will then line the bone side of the surgically created trough. Approximately 3 to 4 mm. of marginal bone was left exposed for the development of a similar width zone of attached gingiva. Dressing will be applied over the band of denuded bone and apically over the periosteum into the depth of the surgical trough.

width zone of attached gingiva. The surgically created trough, having periosteum over the bone surface, will provide ample extension of the vestibule along with a reduction of the healing period and postoperative sequela.

The ten day postoperative result is seen in Fig. *4e*. There was little postoperative pain associated with the procedure since periosteum covered the bone in the vestibular trough extension area. Much of the previously exposed bone is now covered by granulation tissue. The salvaged periosteum has been covered to its coronal extent by granulation tissue that will later become alveolar mucosa. The seventeen day postoperative result is shown in Fig. *4f*. An area of exposed bone, no wider than a pencil line, lies parallel and immediately adjacent to the original coronal extension of the salvaged periosteum. The final result, Fig. *4g*, reveals an adequate zone of attached gingiva and ample extension of the vestibular trough.

Consistent results of this nature make it clear, that by allowing periosteum to cover the bone in the trough extension area, many of the stormy postoperative episodes may be avoided. The principle may be enunciated that only sufficient bone should remain exposed to permit marginal correction and to establish an adequate width zone of attached gingiva.

A preoperative view of another case is seen in Fig. *5a*. Five mm. pockets were present in the first and second molar area. Both molars had buccal bifurcation involvements. A heavy buccal plate was also anticipated. Pocket depth was recorded on the buccal gingiva and a gingivectomy was performed. Only a remnant of attached gingiva remained after the gingivectomy was executed. A modified flap was elevated, the

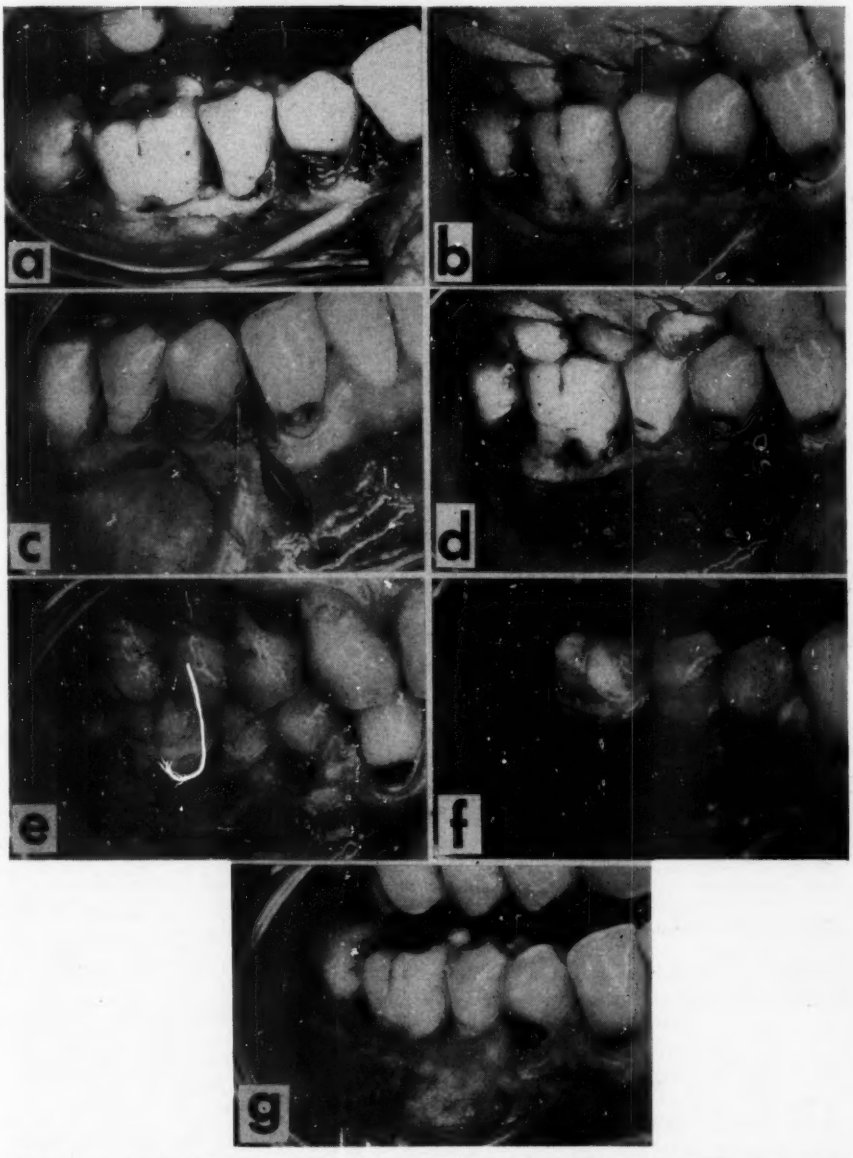

Fig. 4. 4a—Gingivectomy performed and a modified flap reflected for access to bony craters and bifurcation involvement of the first molar. 4b—Osseous surgery. 4c—Oblique vertical incision made into the alveolar mucosa, mesial to the first premolar. 4d—Double flap procedure for extension of the vestibule combined with gingival replacement. 4e—Ten day postoperative result. 4f—Seventeen day postoperative result. 4g—Final result. Ample extension of the vestibular trough has been achieved concomitantly with the development of a new adequate zone of attached gingiva.

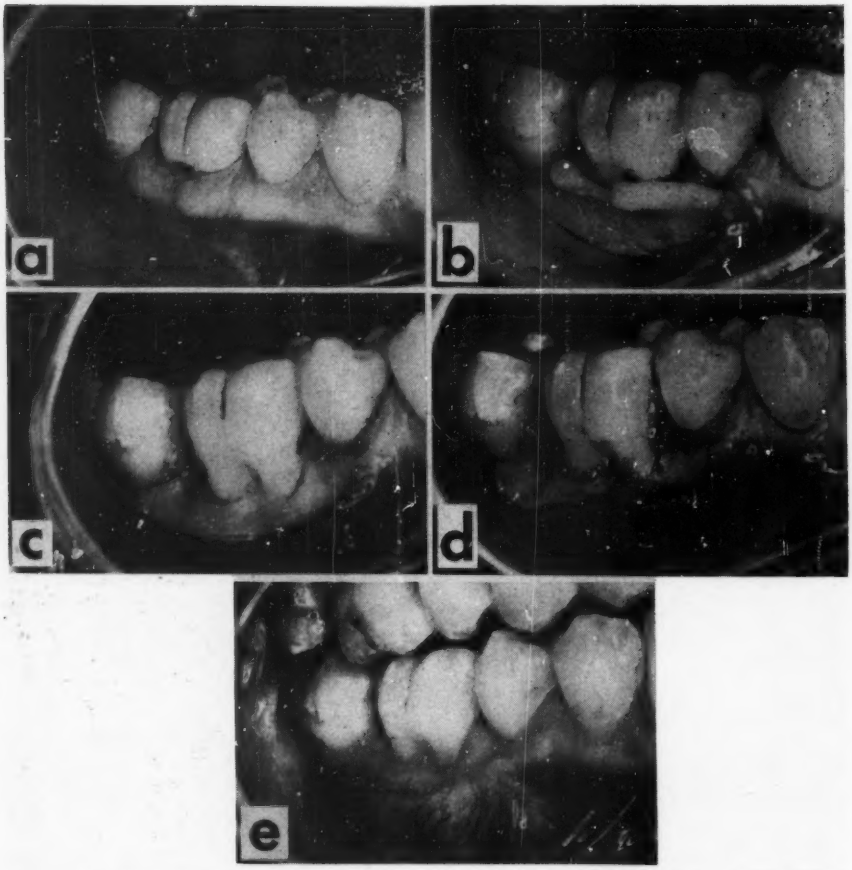

Fig. 5. 5a—Preoperative view. 5b—Gingivectomy performed and a modified flap elevated exposing bony aberrations. 5c—Osseous surgery used for correction of bony aberrations. 5d—Double flap procedure performed for extension of the vestibule combined with gingival replacement. 5e—Postoperative result. The vestibular depth has been increased and a new adequate zone of attached gingiva has developed.

alveolar mucosa and periosteum were drawn apically exposing the marginal bone, Fig. *5b*. A bizarre bony lesion is evident along with an interproximal crater and buccal bifurcation involvements. Osseous surgery made possible the development of physiologic form in the bone, Fig. *5c*. If a new zone of attached gingiva had been the only goal of therapy, the procedure could have terminated at this point. An oblique vertical incision was made in the alveolar mucosa at the anterior extension of the modified flap and the peeling was carried distally to the second molar and apically to provide adequate vestibular depth.

In Fig. *5d*, exposed marginal bone and salvaged periosteum are evident along with the surgically created vestibular trough. Periosteum covers all bone except the band of denuded bone designated for the zone of attached gingiva. The alveolar mucosa will cover the salvaged periosteum but will not project coronally beyond the limits of the periosteum. The postoperative result is seen in Fig. *5e*.

There are definite advantages to utilizing the method described for separating

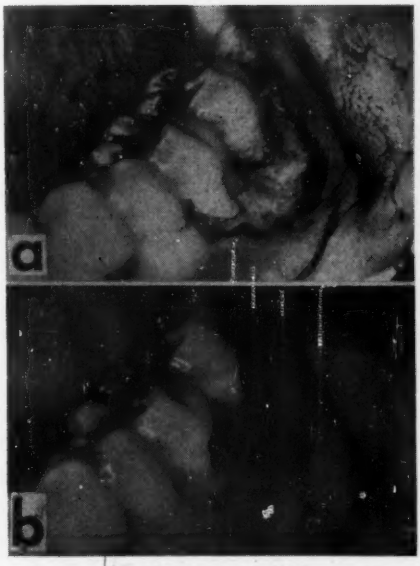

Fig. 6. 6a—A band of denuded bone should be surgically created in an area where the anatomy of the mandible limits the extension of the vestibular trough. The therapist should attempt to have only a zone of attached gingiva in such instances. 6b—Postoperative result. An adequate zone of attached gingiva is present, particularly in the distobuccal area of the second molar.

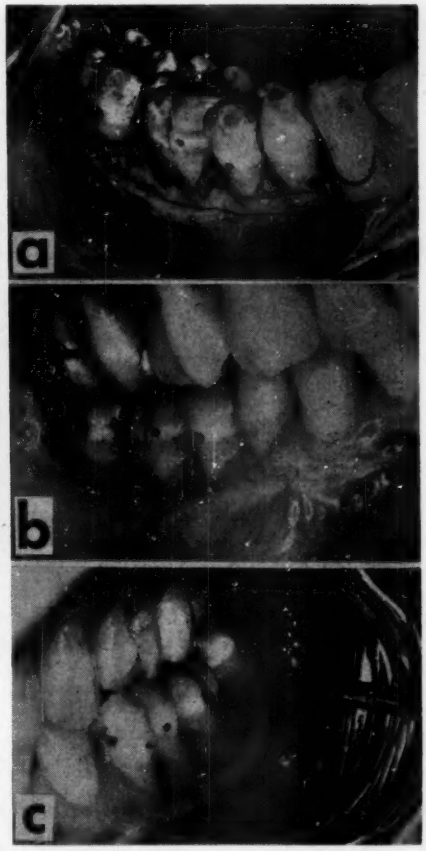

Fig. 7. 7a—Double flap procedure with the periosteum being retained near the bone margin, in an attempt to reduce postoperative pain and healing time. 7b—Postoperative failure. Alveolar mucosa formed over the salvaged periosteum and a narrow zone of attached gingiva developed where the narrow band of marginal bone was left denuded. 7c—Postoperative result on the opposite quadrant of the same arch in Fig. 7a and 7b. Periosteum was not retained near the bone margin, a 4 to 5 mm. band of bone was left denuded; a similar width zone of attached gingiva developed.

the alveolar mucosa from the periosteum. Not only does it reduce the healing period and postoperative pain but it also provides technical advantages. The separation of the two tissues is easy and rapid since the periosteum is not detached at the anterior or posterior extension of the flap. This factor has merit because it will assist in maintaining the periosteum at the proper level desired by the therapist.

The oblique vertical incision will allow adequate draping of the alveolar mucosa. The therapist should not have to depend solely upon the surgical dressing to hold tissue down or to prevent it from being pushed down.

The anatomy of the mandible will occasionally prevent the extension of the vestibular trough. The buccal aspect of the mandibular second molar is a common site for this problem. After gingival surgery, the distance from the gingival margin to the vestibule is inadequate to have both a zone of attached gingiva and alveolar mucosa. This may be complicated further by a heavy external oblique ridge, that will not permit the establishment of an adequate bevel on the buccal bone. In such instances the therapist will have to accept the limited distance and the anatomical circumstances and use them to the best advantage. Therefore, he should attempt to

have only attached gingiva from the margin to the vestibule, as demonstrated in Fig. 6. A band of denuded bone should be surgically created that will produce this zone of attached gingiva, Fig. *6a*. The postoperative result is viewed in Fig. *6b*.

EARLY RESULTS WITH THE DOUBLE FLAP PROCEDURE

During the early work with the gingival replacement and vestibular extension the author was impressed with the postoperative healing that occurred when some of the periosteum was retained over bone. Since postoperative complications were reduced by having periosteum cover the bone in the vestibular extension area, it seemed reasonable that further improvement could be made if the periosteum covered as much bone as possible. Therefore, it was thought that the ideal situation would exist when periosteum covers bone from the bottom of the surgically created trough to the margin of the bone. Fig. *7* illustrates the results obtained from this type of therapy.

Routine procedures were carried out as described previously. However, when the modified flap was elevated for access for bone surgery, only a minimum of tissue was reflected from the bone. A short bevel was made on marginal bone, instead of the customary long bevel, as every effort was made to keep the periosteum intact and in a coronal position. In Fig. *7a*, note the relation of the periosteum to the bone. Even though the cheek retractors used for photographic purposes have a tendency to pull the periosteum apically, the periosteum is only approximately 1 or 2 mm. from the bone margin.

The primary goal was successful, i.e. most of the periosteum was salvaged and then maintained near the margin of the bone during healing. However, the results from this successful effort produced the poorest postoperative result yet obtained of any attempt to achieve a new zone of attached gingiva, Fig. *7b*. Alveolar mucosa formed over all salvaged periosteum and attached gingiva developed only where bone was left exposed. Notice the narrow zone of attached gingiva. Compare the occluso-apical width of this zone of new attached gingiva with the narrow band of exposed bone in Fig. *7a*.

The left mandibular quadrant of the above case presented the same preoperative conditions as the right quadrant. The procedure for the left quadrant was identical to the right side except that the periosteum was *not* retained near the bone margin as before. Approximately 4 or 5 mm. of marginal bone was exposed. The postoperative result, Fig. *7c*, reveals a wide band of attached gingiva which should be compared with the poor postoperative result in Fig. *7b*.

While rigid controls are admittedly impossible in clinical investigations, there has been collected a large enough mass of evidence to deduce certain patterns of behavior of the tissues involved in these procedures. In this report evidence has been submitted which will enable the therapist to use these behavior patterns to his advantage.

SUMMARY AND CONCLUSION

Two basic principles were enunciated in mucogingival surgery. The first was the amount of new attached gingiva will be roughly equal to the amount of marginal bone exposed. The second principle was that vestibular trough extension may be performed more expeditiously and with less postoperative complication if the periosteum is allowed to remain on the bone up to the proposed mucogingival line.

705 West 19th Street

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AMERICAN ACADEMY OF PERIODONTOLOGY

Annual Meeting, October 13, 14, 15, 1960

The 1960 Annual Meeting of the American Academy of Periodontology will be held at the Miramar Hotel, Santa Monica, California, October 13, 14 and 15, 1960. Details of the program may be found on page 254.

Members of the Academy are reminded that each active and each associate member shall be required to attend one annual meeting in a five-year period in order to remain in good standing. (Bylaws Chapter I, Membership, Section 4). Guests are welcome and there will be a nominal registration fee. For further information write Dr. Clarke Chamberlain, Secretary, American Academy of Periodontology, 1101 North Street, Peoria, Illinois.

DR. C. R. ELLIS

Dr. C. R. Ellis of Lexington, Kentucky, died February 22, 1960 in the Good Samaritan Hospital in Lexington. Dr. Ellis began his practice in Shelbyville, Kentucky in 1919 and moved to Lexington in 1926 and specialized in the practice of periodontology. He has held all of the offices in the Blue Grass Dental Society and was active in the Masonic Lodge in Louisville. He was a lieutenant colonel in the Army in World War I and was active in all phases of organized dentistry.

The Epithelial Attachment

by MAX M. WEINREB, D.D.S., M.S., *Jerusalem*

THE relation of gingival epithelium to the enamel of the tooth has once again become a disputed question. Since the existence or non-existence of an organic union between enamel surface and epithelium might mean a radical change in the concepts of periodontal biology and pathology, as well as in the practice of Periodontia and Restorative Dentistry, it is important that this question should be reviewed and examined critically. Furthermore irrefutable experimental proof should be adduced to support either of these concepts.

REVIEW OF LITERATURE

For a long time the relation of gingival epithelium to the enamel was considered as only one of close approximation. It was believed that a space existed between the gingival epithelium and enamel, which extended to the cemento-enamel junction from the time the tooth had erupted into the oral cavity. Thus Black[1] wrote in 1915 that ". . . a thin blade may readily be passed between the gingiva and the enamel, raising the tissue and exposing the sub-gingival space between it and the enamel. This tissue has no attachment to the tooth until the gingival line on the tooth is reached." This concept, based upon Black's clinical observation was superseded by Gottlieb's discovery in 1921 of the "Epithel-Ansatz"—epithelial attachment. Based upon microscopic evidence, Gottlieb[2] found an organic connection between enamel surface and gingival epithelium. Thus only a shallow crevice exists near the free border of the gingiva.

Since the enamel is normally lost during histologic preparation and thus normal relations are disturbed, it has been difficult to prove this relation with the available technical methods.

Indirect proof for Gottlieb's concept has been adduced by several investigators, using various techniques.

Thus Bodecker and Applebaum[3] investigated the firmness of the epithelial attachment on ground sections which were produced according to a special method and found an organic union to exist between epithelium and enamel.

Toller[4-6] showed this attachment to be quite strong. He froze the teeth and surrounding tissues of young dogs and ground them into relatively thin sections. These

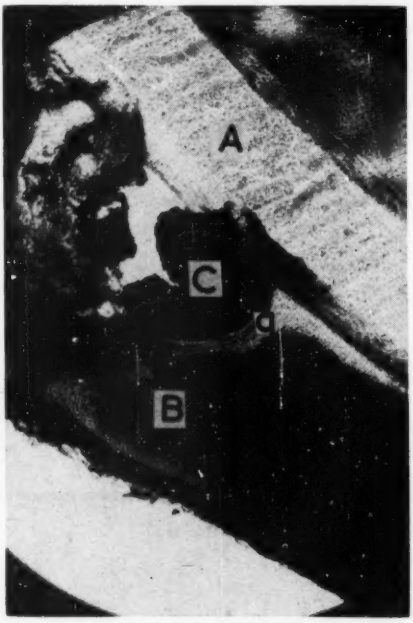

Fig. 1. Microphotograph of incisor of monkey. A—enamel, B—Gingiva, C—Acrylic introduced into sulcus, a—Epithelial lining of pocket and epithelial attachment. Methyl-methacrylate embedded, Regaud's Haematoxylin, x 60. (Ground section.)

Department of Anatomy, Schools of Medicine and Dentistry, The Hadassah-Hebrew University, Jerusalem.

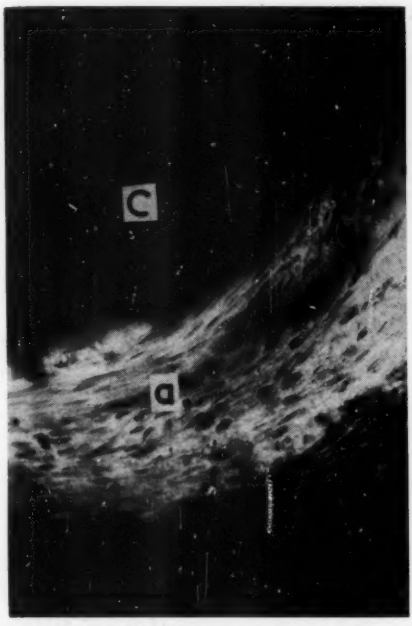

Fig. 2. Higher magnification of *a* in fig. 1, showing the epithelial lining of the pocket *a* under the acrylic C. (x 430.)

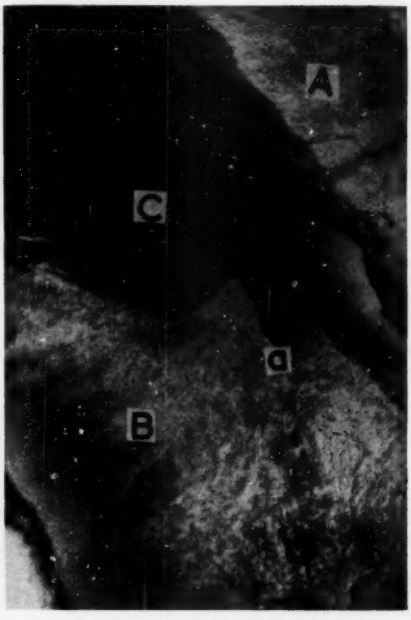

Fig. 3. Photomicrograph of incisor of monkey. A—enamel, B—Gingiva, C—Acrylic introduced into sulcus, a—epithelial lining of pocket under acryl and epithelial attachment. Methylmethacrylate embedding Kernichrot, x 100. (Ground section.)

were placed under the dissecting microscope and the free margin of the gingiva was pulled away from the tooth with a needle. By this method it was possible to demonstrate that the attachment can be severed from the tooth only to a certain depth; from thence it tears rather than separates from the tooth.

Another confirmation of the organic connection between tooth surface and epithelium is the fact that after extraction of teeth, epithelium is often found adherent to the extracted tooth.[7, 8]

Macapanpan[9] adduces two chance findings during histologic preparation of specimen, demonstrating a) a stronger attachment between enamel and epithelium than between enamel and dentin; b) a firmer union between enamel and epithelium than between the epithelial cells themselves.

Butcher[10] used a special way of decalcification which retained some of the enamel and also found that "when the enamel epithelium is pulled away, portions of it remain attached to the enamel."

Recently, this whole concept has been challenged by Waerhaug.[11–14] He asserted[11] that "The bottom of the clinical pocket was found to be situated consistently at the cemento-enamel junction." . . . "Thus it was evident that no epithelial attachment existed." He further amplifies these statements by saying that "the bottom of the clinical pocket is situated at the deepest line of epithelial attachment, thus the 'epithelial attachment' belongs to the lining of the pocket."

Orban et al[15] repeated some of Waerhaug's experiments and refuted his findings. They state that "the gingival epithelium is in the true sense of the word, attached to the enamel."

Both Waerhaug's and Orban's experi-

Fig. 4. Specimen similar to that in fig. 3. A—enamel, B—Gingiva, a—epithelial attachment in close union with enamel. x 100. (Ground section.)

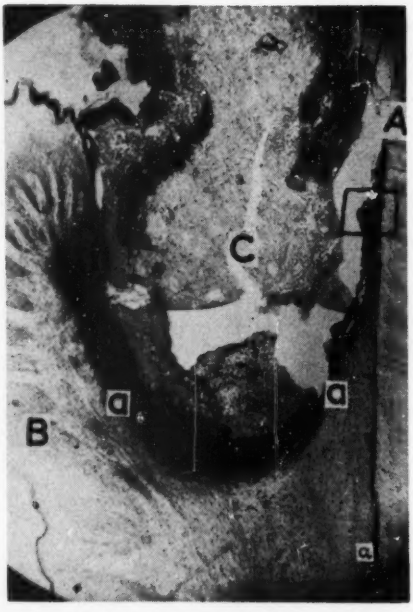

Fig. 5. Microphotograph of incisor of monkey. A—enamel, B—Gingiva, C—"Cavit" introduced into pocket, a—epithelial lining of pocket and epithelial attachment. Bioplastic embedded. Methylene blue. x 60. (Ground section.)

mental material was processed by the usual histologic technique, which involves decalcification. Since the enamel was lost, proof here again was only an indirect one.

Recently developed methods of obtaining stained ground sections of soft and hard tissues[16] permit re-examination of this question. By retaining both the enamel as well as normal relations, direct proof of the relation between gingival epithelium and enamel surface could be adduced.

MATERIALS AND METHODS

Fifteen monkeys of various ages as well as two cats served as experimental animals. Four different types of experiments were conducted on these animals in the stage of surgical anesthesia or within one hour after death:

A. Filling of the Gingival Pocket. The gingival pockets around some teeth were washed with tepid water, dried with compressed air and filled. Two materials were used:

(1) *Self-curing acrylic:* This was introduced into the pocket as a thin mix by means of a small and thin dental spatula and carefully pushed down to the bottom of the pocket. More material was added and kept under pressure while the plastic set.

(2) *A Temporary Filling Material—"Cavit."* This material comes in tubes and is a temporary filling material of putty consistency. When it comes into contact with water or saliva, it sets and becomes hard —comparable to a Zinc-Oxide-Eugenol Cement. This material was packed into the pockets and pressed down into them quite forcefully.

B. Insertion of a Steel Blade into the Gingival Sulcus. Fine Steel Blades, 0.5 mm.

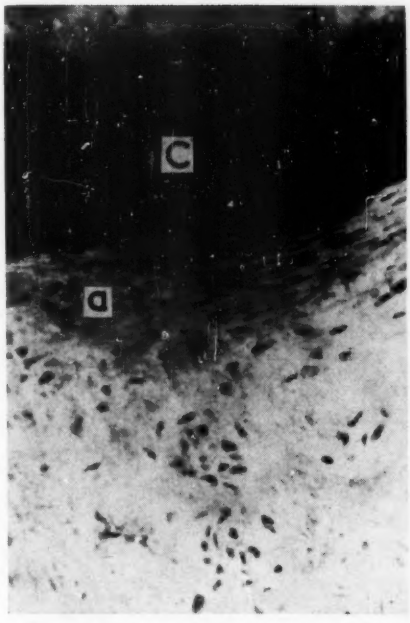

Fig. 6. Higher magnification of *a* in fig. 5. C—"Cavit", a—epithelial lining of pocket. x 430.

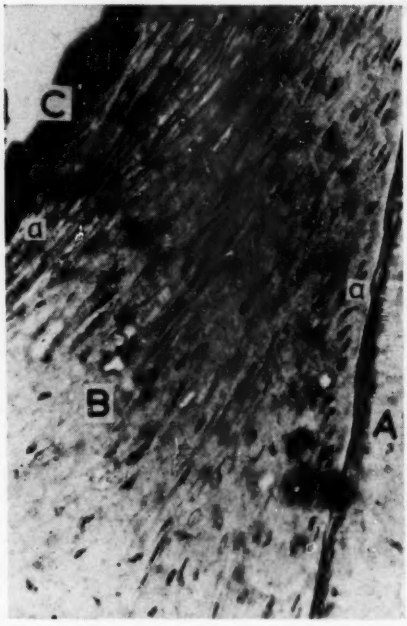

Fig. 7. Higher magnification of area of epithelial attachment in fig. 5. A—enamel, B—Gingiva, C—Cavit, a—epithelial attachment and pocket lining. x 430.

thick and 1 mm. wide were prepared according to Waerhaug's[11] specifications. They were rounded, made smooth and bent into some conformity with the curvature of the tooth surface. They were then carefully inserted into the pocket until they met with definite resistance. Either self-curing acrylic or "Cavit" were used to fix this steel blade to the tooth.

C. Insertion of Plastic Strips into the Gingival Sulcus. Following a suggestion by H. A. Zander[17] a strip of thin plastic—resembling the steel blades in part B—was similarly introduced into the gingival crevice and fixed with self-curing acrylic.

D. Gingival Flaps. Again in accordance with Waerhaug[11] . . . "a lobe of gingiva was detached from the rest by means of a sharp lancet cutting two vertical incisions from the gingival margin." The flap was pulled away from the tooth to the crest of the alveolar bone, then laid back and sutured.

In a variation of this experiment, only one vertical incision was made as above, the triangular flap pulled away and sutured in a reflected position.

Histologic Processing. All the specimen were fixed immediately in 10% formalin. They were then dehydrated and cleared in methyl salicylate. Bioplastic* (a commercially available plastic for biologic uses) was used to embed the specimen. Several intermediary mixtures of bioplastic and methyl salicylate served for infiltration and pure bioplastic with added catalyst served for the preparation of the blocks.

Both manual as well as mechanical preparation of sections was used and these were stained with several stains.

This method is published in detail elsewhere.[16]

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*Ward's Natural Science Establishment, Inc.

Fig. 8. Specimen similar to fig. 5. A—enamel, a—enamel epithelium (epithelial attachment) with still functioning ameloblasts. x 430.

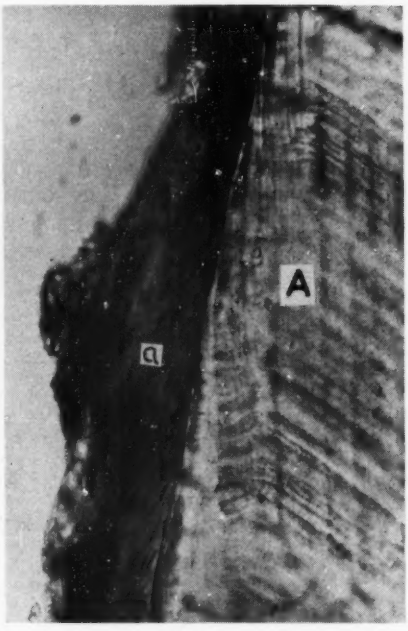

Fig. 9. Higher magnification of the area indicated by a square in fig. 5. A—enamel, a—epithelial attachment that remained in close union with the enamel. x 430.

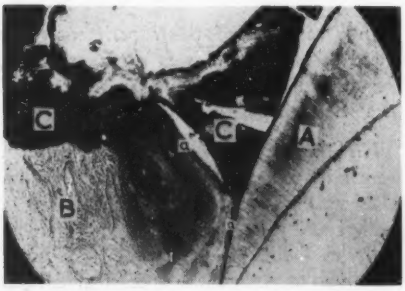

Fig. 10. Microphotograph of monkey molar. Cavit had been introduced into the sulcus with excessive force and almost reached the alveolar bone. The epithelial attachment to the enamel was not disrupted. A—enamel, B—Gingiva, C—Cavit, a—epithelial attachment. Bioplastic embedded; Methylene blue. x 60. (Ground section.)

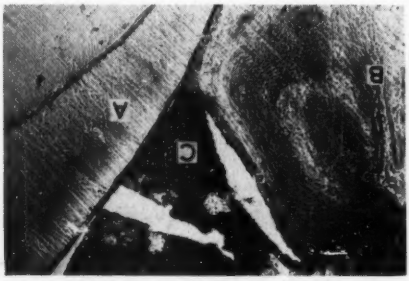

Fig. 11. Higher magnification of the area of epithelial attachment in fig. 10. A—enamel, B—Gingiva, C—Cavit, a—epithelial attachment. x 100.

FINDINGS

A. Filling of the Gingival Pocket. All the specimens in which the gingival sulcus was filled with either self-curing acrylic or "Cavit" showed essentially the same picture and therefore the results can be grouped together.

The gingival pocket usually was distended, flared out and was filled with material. In no instance did the material succeed to penetrate the epithelial lining of the pocket. Compressed and flattened epithelial cells can be clearly seen on the surface of the tissues under the foreign materials (Fig. 1, 2). There was no break in the continuity of the epithelium and it

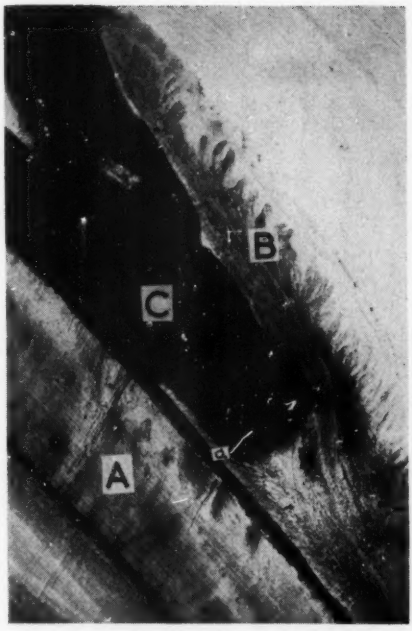

Fig. 12. Photomicrograph of incisor of monkey. A metal strip had been introduced into the sulcus. A—enamel, B—Gingiva, C—Metal strip, a—epithelial attachment. Bioplastic embedded; Methylene blue. x 35. (Ground section.)

Fig. 14. Microphotograph of ground section of monkey molar. A metallic strip had been introduced into the sulcus. A—enamel, B—Gingiva, C—Metallic strip, a—severed epithelial attachment. Bioplastic embedded. Methylene blue. x 100.

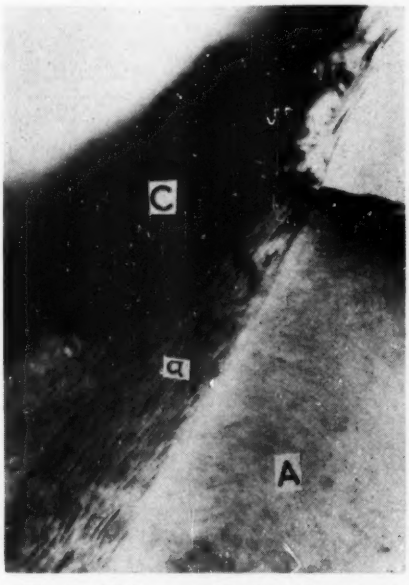

Fig. 13. Higher magnification of area *a* in fig. 12, giving details of the epithelial attachment. x 430.

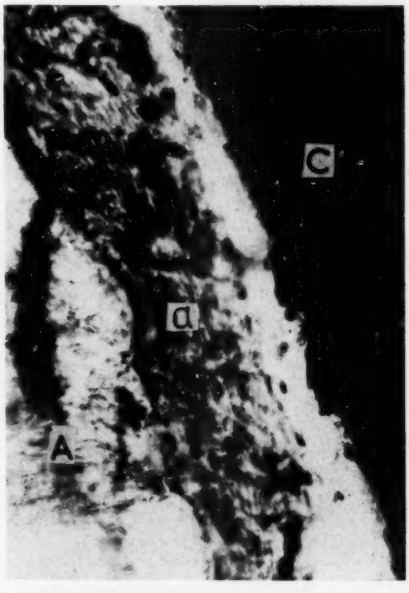

Fig. 15. Higher magnification of area of severed epithelial attachment in fig. 14. A—enamel, C—Metallic strip, a—cells of epithelial attachment that remained in union with enamel. x 430.

Fig. 16. Cervical part of the tooth in fig. 14, showing the continued attachment of the enamel epithelium (ep. attachment) to the enamel. A—enamel, a—enamel epithelium. x 430.

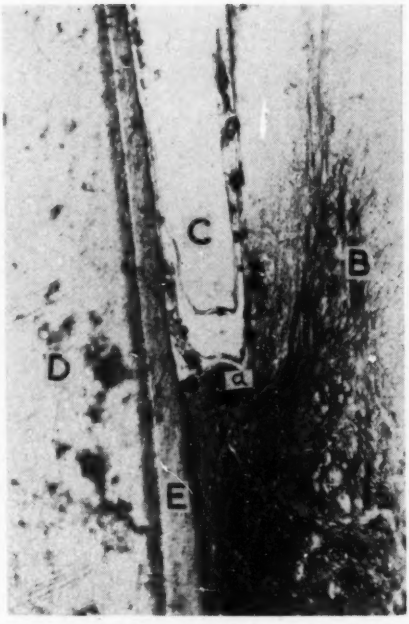

Fig. 18. Higher magnification of fig. 17. D—Dentin, E—Cementum, B—Gingiva, C—Plastic strip, a—epithelial attachment. x 100.

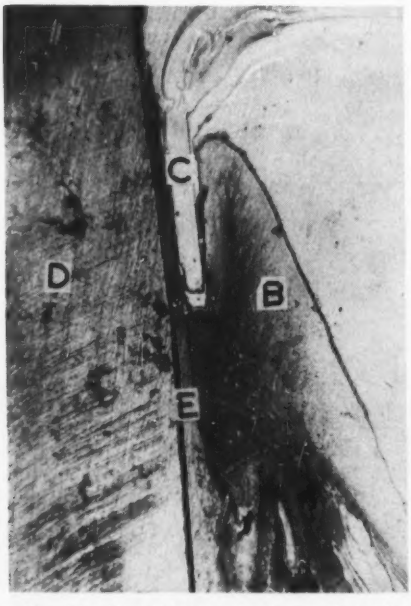

Fig. 17. Photomicrograph of ground section of monkey molar. A plastic strip had been introduced into the sulcus. D—Dentin, B—Gingiva, C—Plastic strip, E—Cementum. Bioplastic embedded. Methylene blue. x 35.

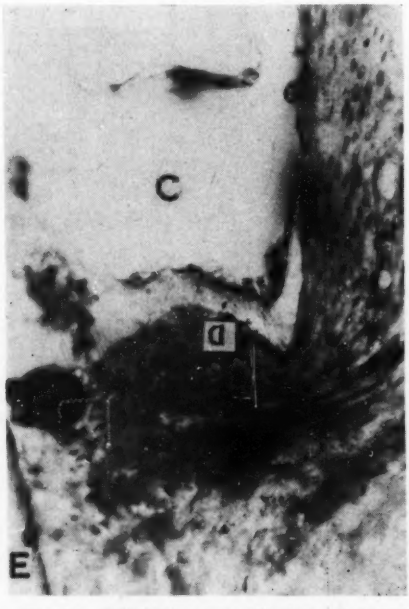

Fig. 19. Still higher magnification of fig. 17. E—Cementum, C—Plastic strip, a—epithelial attachment. x 430.

Fig. 20. Microphotograph of a specimen similar to that of fig. 17, showing also the persistence of the epithelial attachment. x 430.

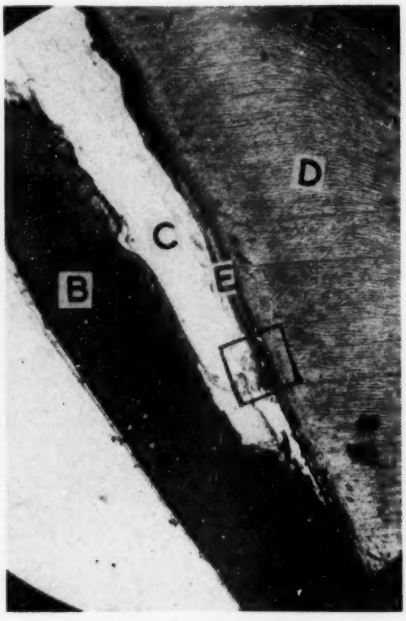

Fig. 21. Photomicrograph of ground section of monkey incisor. A plastic strip had been inserted into the sulcus a little more forcefully. The strip severed the epithelial attachment but did not succeed to detach the epithelium from the cementum. D—Dentin, B—Gingiva, E—Cementum, C—Plastic strip. Bioplastic embedded. Methylene blue. x 60.

continued from the oral epithelium under the material in the pocket to its firm and undisturbed union with the enamel (Fig. 1, 3). From this point the enamel epithelium (epithelial attachment) can be followed apically to the cemento-enamel junction—always in close and intimate union with the enamel (Fig. 4). In no instance did the material introduced arrive anywhere near the cemento-enamel junction.

When "Cavit" was used, there was a tendency for using slightly more force in pressing the material into the sulcus. This resulted in some compression of the tissues and sometimes the pocket assumed the shape of a crater-like depression. But also in these cases all the previous findings held true (Figs. 5-8). The epithelial attachment was not severed from its union with the enamel and it can be seen coronally to the deepest point of the filled sulcus (Fig. 9).

In some instances *extreme* pressure was used when filling the gingival sulcus. In these cases the force used was sometimes so great that the material introduced severed both the epithelial lining of the pocket as well as the underlying connective tissue and came into contact with the alveolar bone (Fig. 10). Even in these extreme cases the epithelial attachment remained attached to the enamel surface (Fig. 11).

B. Insertion of Steel Blades into the Gingival Sulcus. When the steel blade was inserted very carefully and no pressure was exerted, it reached only to the bottom of the sulcus (Fig. 12). The attachment of the epithelial cells to the enamel surface was left intact (Fig. 13).

However, in most cases the pressure exerted was too great, the steel blade reached the bottom of the sulcus and from here

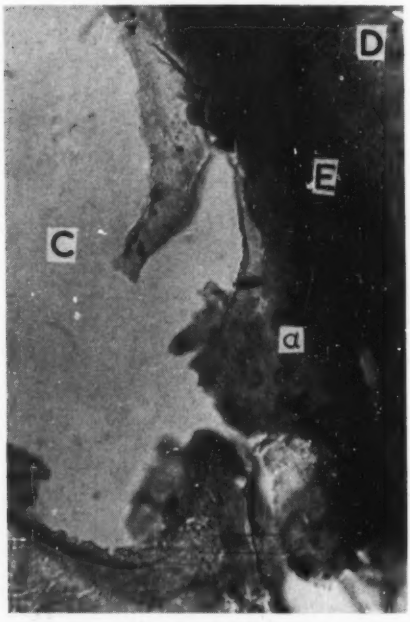

Fig. 22. Higher magnification of the area indicated by a square in fig. 21, showing the epithelium that remained adherent to the cementum. D—Dentin, E—Cementum, C—Plastic strip, a—epithelium. x 430.

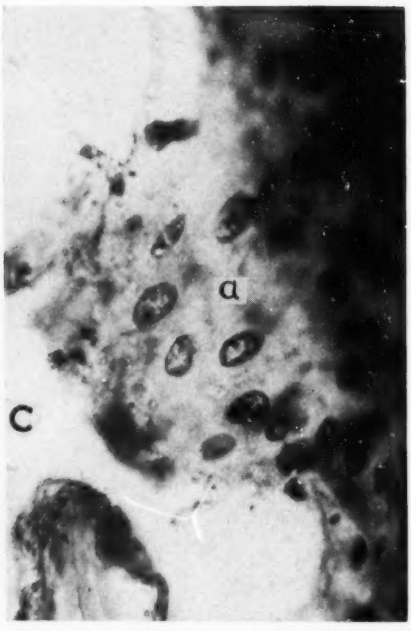

Fig. 23. Still higher magnification of the area indicated by a square in fig. 21. C—Plastic strip, a—epithelium. x 970.

progressed *within* the epithelium—between a layer of cells that remained attached to the enamel and the rest of the epithelial attachment (Fig. 14, 15).

There was never a separation of the intact epithelial attachment from the tooth surface. Even when considerable force was used the steel blade did never reach the cemento-enamel junction. In the cervical part of the tooth, the reduced enamel epithelium (epithelial attachment) could always be seen in close union with the surface of the enamel (Fig. 16).

C. Insertion of Plastic Strips into the Gingival Sulcus. In no case did the insertion of a plastic strip succeed to separate the epithelium from the enamel or cementum.

If no undue pressure was used, the plastic strip met resistance at the bottom of the clinical pocket, compressed and flattened the cells of the epithelial pocket lining, but did not penetrate the latter (Fig. 17-19). Fig. 19, 20 show clearly the compressed epithelial cells immediately below the end of the plastic strip and their firm union to the surface of the cementum.

If more force was used when the strip was pushed down into the pocket, it penetrated and even tore the epithelium (Fig. 21). However, even in these cases of extreme force being applied, there was never a separation of epithelium from the enamel or cementum, and part of it always continued to remain in close union with the hard tooth surface (Fig. 22, 23).

D. Gingival Flaps. Separation of gingival flaps caused an unmistakable tear through the epithelium into the connective tissue down to the alveolar bone. The entire epithelial attachment, however, remained attached to the tooth (Fig. 24, 25).

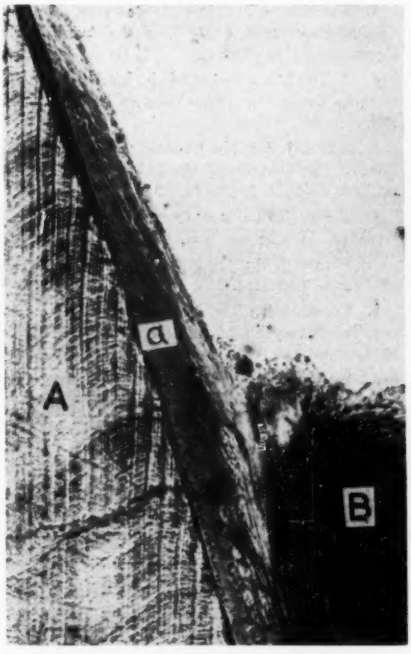

Fig. 24. Microphotograph of ground section of incisor of monkey. A gingival flap was raised and sutured in a reflected position. A—enamel, B—Gingiva, a—epithelial attachment. Bioplastic embedded. Methylene blue. x 100.

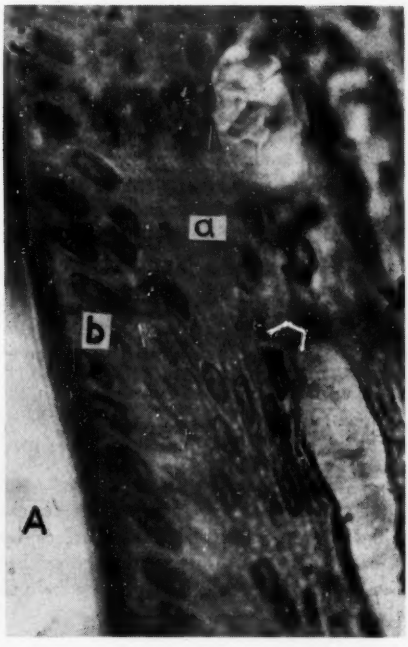

Fig. 25. Higher magnification of the attached epithelium in fig. 24. a—enamel epithelium, b—ameloblasts. x 970.

DISCUSSION

A discussion of an attachment of epithelium to enamel should be divided into two different periods:

(a) Before the end of Amelogenesis. Orban[15] found that in the great majority of erupting teeth in dogs which had already been exposed to the oral cavity, amelogenesis was not yet completed in the cervical part of the crown. Our findings show the same to be true in monkeys. In the cervical region fully differentiated and functioning ameloblasts can still be observed (Fig. 8). It is obvious that ameloblasts and their rods form an organic union during the process of amelogenesis. These facts refute Waerhaug's claim that from the moment a tooth erupts into the oral cavity, the gingival sulcus reaches to the cemento-enamel junction.

(b) After the end of Amelogenesis. In no case were we able to separate the epithelium cleanly from the enamel, as claimed by Waerhaug. When gingival flaps were raised, tears occurred within the epithelial attachment, leaving cells attached to the enamel. This fact is in accord with the findings of Kronfeld,[8] Orban and Muller,[18] Ussing[19] as well as Toller.[4-6]

None of our strips introduced, reached the cemento-enamel junction as stated by Waerhaug. They penetrated either to the bottom of the sulcus, or into the epithelium itself and through it into the connective tissue. Epithelial cells always remained adherent to the enamel.

Even filling the gingival sulcus under extreme pressure did not separate the attached epithelium from the enamel.

From all these findings we have to conclude that the gingival epithelium is in the

literal sense of the word attached to the enamel surface.

SUMMARY AND CONCLUSION

A new histologic method of obtaining stained ground sections of both soft and hard tissues was used in order to reinvestigate the relation of gingival epithelium to the hard tooth surface.

Filling of the gingival pocket with either "Cavit" or a self-curing acrylic served to demonstrate the continued adherence of the epithelial cells to the hard tooth substance.

The introduction of thin strips into the gingival sulcus did not detach the epithelial attachment from its union with the hard tooth surface.

It was equally impossible to detach the gingiva from the hard tooth surface by flaps without causing tears in the epithelium, part of which continued to adhere to the tooth.

Therefore it can be concluded that there is a definite union between the gingival epithelium and the hard tooth surface.

ACKNOWLEDGEMENT

The author wishes to express his sincerest thanks and appreciation to Prof. M. Ickowicz, head of the department, for his constant advice and encouragement.

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ARPA Suisse (Society of Periodontology) in Basel, Switzerland, is meeting in conjunction with the 500th birthday of Basel on August 26 to 28, 1960. American periodontists who plan to be in Europe about that time may wish to include this on their agenda. For further information write Dr. P. E. Sutter, Falknerstr. 12, Basel, Switzerland.

Normal Glucose Tolerance Pattern: Development of Blood Glucose Normality by Analysis of Extraoral Symptoms*

by E. CHERASKIN, M.D., D.M.D.,** C. BRUNSON, B.S.,*** AND J. D. GOODWIN, B.S.,***
Birmingham, Alabama

THERE is still considerable debate as to what should be regarded as the *normal* glucose tolerance pattern. The presently accepted range has been developed by an analysis of presumably healthy individuals. A report has already been released[1] in which the glucose tolerance pattern in a group of dental patients with and without oral symptoms has been analyzed. The symptoms which were studied (gingival tenderness, stomatopyrosis and xerostomia) were those which are ordinarily recognized as being common findings associated with diabetes mellitus.

This report is designed to analyze the glucose tolerance pattern in a group of dental patients with and without *extraoral* symptoms usually regarded as common findings in patients with diabetes mellitus.

REVIEW OF THE LITERATURE

To appreciate the design and results of this study, it is necessary to review briefly: (1) the common extraoral symptoms associated with diabetes mellitus, (2) the present basis for the so-called normal glucose tolerance pattern.

EXTRAORAL SYMPTOMS

The three most commonly reported extraoral symptoms believed to be associated with diabetes mellitus are: (1) *polyphagia*, (2) *polyuria*, and (3) *polydipsia*.

Polyphagia: A number of periodicals and textbooks make mention of the fact that an increase in appetite is commonly associated with diabetes. Most of these reports[2-5] simply state that there is a relationship. Some few attempt to report actual figures. For example, Barach[6] claimed, in his series of 355 diabetic patients, that 66 percent offered increased hunger as a primary complaint. Danowski[7] contends that, in his series of children and adolescents, 44.44 percent of the group complained with polyphagia. Sheridan et al.,[8] in their study of 100 routine dental patients, discovered among the diabetic individuals 23 percent with increased appetite and 15 percent who reported a reduction in appetite.

Polyuria: A number of periodicals and textbooks also make mention of the fact that an increase in urination is commonly associated with diabetes mellitus. Most of these papers[4] simply state that there is a significant relationship. Some few attempt to report actual figures and conditions under which polyuria exists. Lawrence[5] indicates that polyuria is rarely present until the blood sugar is greater than 250 mg. percent. This then can be interpreted to mean that polyuria is not an early finding in diabetes mellitus. Danowski,[7] in his study of 513 juvenile diabetic patients, observed polyuria in 78.36 percent. Barach[6] studied 355 diabetic individuals. He observed as primary complaints that 75 percent reported frequent urination and 18 percent indicated the passage of two or more quarts of urine per day. Sheridan and his colleagues,[8] from their study of 100 routine dental patients, observed that 38 percent indicated increased and 4 percent decreased excretion among the previously unrecognized diabetic individuals.

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Polydipsia: Mention is made in many periodicals and textbooks that an increase in thirst is to be regarded as a common finding in patients with diabetes mellitus. Danowski[7] from his study of 513 juvenile diabetic patients, observed polydipsia in 75.82 percent. Sheridan and his group[8] noted 19 percent of the diabetic patients with increased and 4 percent with decreased thirst. However, in most instances, reference is only made to the relative frequency of this finding.[4, 5]

NORMAL GLUCOSE TOLERANCE PATTERN

There are two general approaches for establishing normal values[9]: (1) *statistical analysis,* and (2) *physiologic analysis.*

Statistical Analysis: In general the values for the normal glucose tolerance pattern have been derived from the examination of *presumably* healthy individuals. In most cases, subjects have been regarded as well if *relatively* asymptomatic. Mosenthal and Barry[10] have published a set of values which are now generally regarded as the normal glucose tolerance pattern. Their conclusions have been based upon the findings in 50 ambulatory hospital workers. These investigators suggest that the normal glucose tolerance test is represented by a fasting venous glucose level of 100 mg. percent or less, no venous blood glucose level greater than 150 mg. percent and a return of the blood glucose level to 100 mg. percent or less at the end of two hours. Figure 1 shows specific mean values obtained by Mosenthal and Barry in their study.

Physiologic Analysis: There are no published reports available which attempt to analyze the normal glucose tolerance pattern on the basis of the absence or presence of extraoral symptoms which are commonly associated with diabetes mellitus.

METHOD OF INVESTIGATION

One hundred dental patients were studied in the Section on Oral Medicine at the University of Alabama School of Dentistry. As far as possible, the subjects were selected at random. Table 1 shows the age distribution

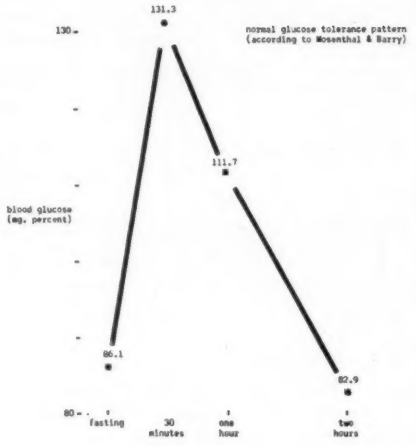

Figure 1

of the group. It can be observed that the pattern approaches a typical unimodal curve. Included in this study were 22 males and 78 females.

Each subject was carefully questioned regarding possible polyphagia, polyuria, and polydipsia. The scoring was made on the basis of a three-point scale. If the patient reported no change, zero was assigned. When the individual indicated increased appetite, thirst, or urination during the preceding six months, then one was recorded. Two was utilized to indicate the presence of decreased polyphagia, polyuria, or polydipsia during the preceding six month interval. Thus, a completely asymp-

TABLE 1
age distribution

age group	*total number of patients*
0- 9	1
10-19	9
20-29	19
30-39	27
40-49	19
50-59	17
60-69	8
Total	100

tomatic patient was given a total score of zero; a patient with polyphagia, polyuria and polydipsia was assigned a value of three.

A true glucose tolerance test was performed on each patient according to the methods of Somogyi[11, 12] and Nelson.[13] No preparatory diet was recommended except for complete fasting for twelve hours prior to the laboratory examination. Complete details regarding the method of investigation are available in the publication by Sheridan and his group.[8]

RESULTS

The findings will be reported in two ways: (1) general characteristics of the entire group, and (2) subgroup analysis.

GENERAL CHARACTERISTICS

Figure 1 pictorially represents the suggested normal glucose tolerance pattern derived by Mosenthal and Barry from a study of 50 presumably healthy hospital workers. Figure 2 summarizes the data derived from a study of 100 routine dental patients. Figure 3 is a composite graphic analysis of the findings in the 50 hospital workers in the Mosenthal and Barry series and the 100 dental patients in the Alabama study. The small mean difference at the fasting level, 30 and 60 minute points in the two groups is not statistically significant ($P > .200$) as outlined in Table 2. The only point at which there is a statistically significant difference of the means is at two hours ($P < .005$).

SUBGROUP ANALYSIS

The three symptoms studied will be analyzed as: (1) *independent*, and (2) *combination* groups.

Single Factors: Three symptoms were analyzed: (1) *polyphagia*, (2) *polyuria*, and (3) *polydipsia*.

Polyphagia: The 100 patients in the Alabama series were divided into two groups: (1) those who reported polyphagia, and (2) those without increased appetite. Seventeen percent of the cases were symptomatic; 72

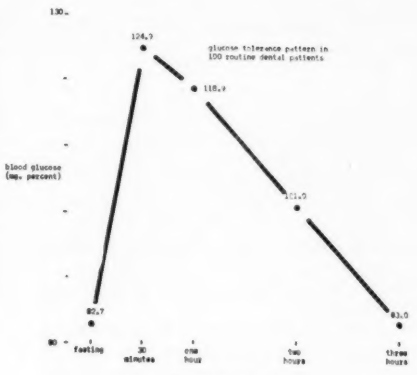

Figure 2

percent were free of this particular symptom. Figure 4 shows the glucose tolerance patterns obtained from these two groups on the basis of the presence or absence of this one symptom. Five points deserve comment. First, the glucose tolerance pattern of the symptomatic group suggests a decrease in tolerance compared with the asymptomatic group. Secondly, in the main, the mean differences are small throughout. Thirdly, the greatest mean difference occurred at the two hour point. Fourthly, the three hour blood glucose in both groups is below the initial level. Fifthly, it is clear

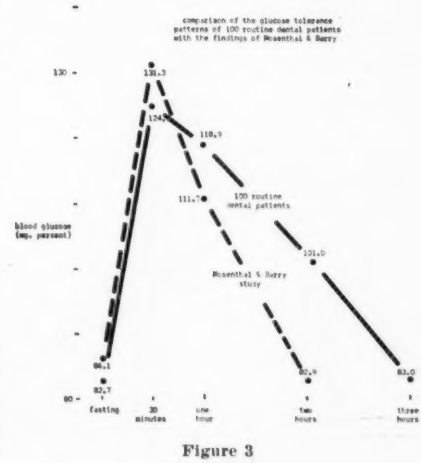

Figure 3

TABLE 2
statistical comparison of mean differences

		blood glucose differences				
		fasting	*30 minutes*	*one hour*	*two hours*	*three hours*
Mosenthal and Barry Study Versus Alabama Study	mean difference	3.400	6.400	7.200	18.100	
	P	> .200	> .200	> .200	> .005	
polyphagia versus no polyphagia	mean difference	8.300	10.900	9.200	12.200	7.100
	P	> .200	> .400	.500	.500	.500
polyuria versus no polyuria	mean difference	9.700	5.400	18.600	23.500	24.300
	P	> .200	.500	> .200	> .100	> .100
polydipsia versus no polydipsia	mean difference	9.400	14.800	18.800	21.300	18.800
	P	> .400	.500	.500	.500	.500
polyphagia-polyuria versus no polyphagia-no polyuria	mean difference	18.900	18.300	26.000	35.700	33.700
	P	< .025	> .400	> .400	> .400	> .400
polyphagia-polydipsia versus no polyphagia-no polydipsia	mean difference	23.900	34.400	46.800	41.000	22.400
	P	.500	.500	.500	.500	.500
polyuria-polydipsia versus no polyuria-no polydipsia	mean difference	20.300	11.800	23.600	32.900	30.800
	P	>0.100	.500	.500	.500	>0.400
polyphagia-polydipsia-polyuria versus no polyphagia-no polydipsia-no polyuria	mean difference	51.700	73.300	102.300	105.600	78.000
	P	<0.005	< .005	< .005	<0.005	<0.025

from Table 2 that there is no statistically significant difference between these two groups.

Polyuria: The 100 patients in the Alabama series were divided into two groups: (1) those who reported polyuria, and (2) those who were asymptomatic in this regard. Seventy-two percent of the individuals proved to be asymptomatic; 27 percent complained with polyuria. Figure 5 shows the glucose tolerance patterns obtained from these two groups on the basis of the presence or absence of this one symptom. Four points are worthy of mention. First, the polyuria group shows a relatively decreased glucose tolerance pattern. Secondly, the mean differences increase at the various temporal points so that the least mean differences are present early in the test and the greatest mean differences at the two and three hour points. Thirdly, the three hour level in the polyuria-free group is below the initial level. In contrast, the three hour

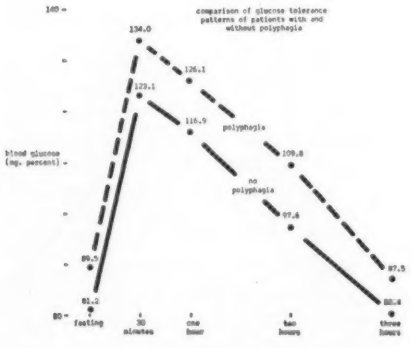

Figure 4

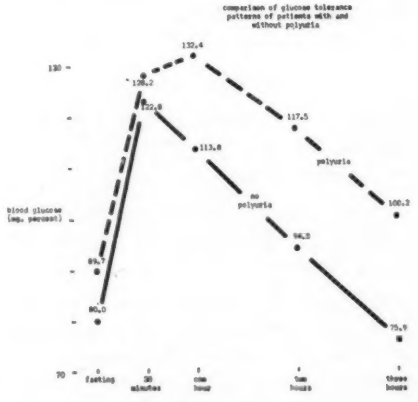

Figure 5

glucose level in the polyuria group is higher than that observed initially. Fourthly, it is clear from Table 2 that there is no statistically significant difference between these two groups.

Polydipsia: The 100 patients in the Alabama series were then divided into two groups: (1) those who reported polydipsia, and (2) those who were asymptomatic in this regard. Eighty-two of the individuals proved to be asymptomatic; 16 complained with polydipsia. Two patients were unrecorded with respect to this symptom. Figure 6 shows the glucose tolerance patterns obtained from these two groups on the basis of the presence or absence of this one symptom. Five points are worthy of mention. First, the polydipsia group shows a relatively decreased glucose tolerance pattern. Secondly, in the main, the mean differences are small throughout. Thirdly, the greatest mean difference occurred at the two-hour level. Fourthly, the three hour blood glucose in both groups is at or below the initial level. Fifthly, it is clear from Table 2 that there is no statistically significant difference at any point between these two groups.

Combination Factors: Three independent symptoms have already been considered. In this section an analysis will be made of the combination of these three symptoms: (1) *polyphagia and polyuria*, (2) *polyphagia and polydipsia*, (3) *polyuria and polydipsia*, and (4) *polyphagia, polyuria*, and *polydipsia*.

Polyphagia-Polyuria: Fifty-five patients did not report the presence of polyphagia and polyuria while 9 did claim that both of the symptoms were present. Figure 7 shows the glucose tolerance patterns of these two groups. Five points deserve special consideration. First, the symptomatic group demonstrates a relative decrease in glucose tolerance. Secondly, the smallest mean difference is observed at the fasting level. Thirdly, the greatest mean difference can be noted at the two-hour period. Fourthly, the three-hour levels are different for the two groups. In the asymptomatic group, the three-hour level is below the initial level. In the symptomatic group the three-hour level is above the findings initially. Fifth and last, it is clear from Table 2 that there is only a statistically significant difference at the fasting level ($P < .025$).

Polyphagia-Polydipsia: Of the 100 patients in the series, 62 individuals did not report the presence of polyphagia nor polydipsia; 6 demonstrated both symptoms. Figure 8 graphically depicts the glucose tolerance patterns of these two groups. There are five points which deserve men-

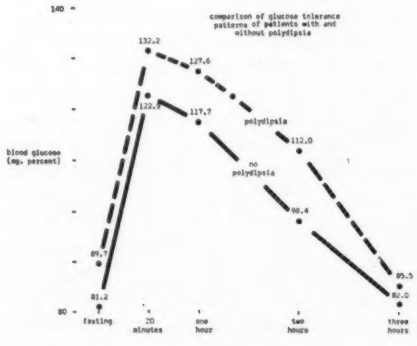

Figure 6

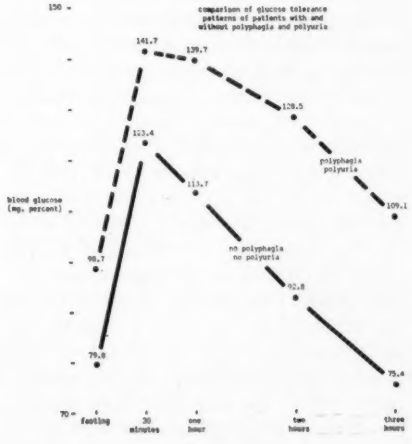

Figure 7

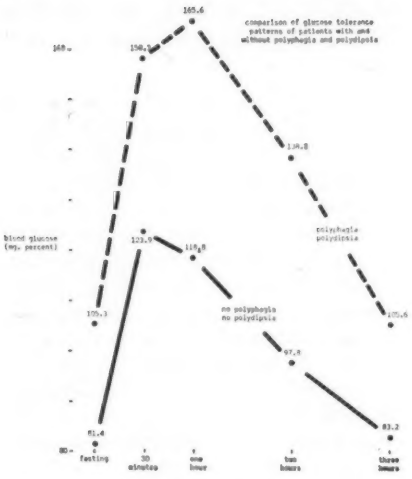

Figure 8

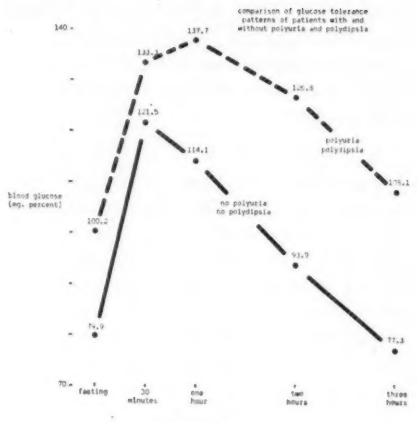

Figure 9

tion. First, the symptomatic group demonstrates a relative decrease in glucose tolerance. Secondly, the smallest mean differences are observed initially and at the three-hour level. Thirdly, the greatest mean difference can be noted at the one-hour point. Fourthly, the three-hour levels approach very closely the initial findings. Fifthly and lastly, it is clear from Table 2 that there is no statistically significant difference at any of the time intervals.

Polyuria-Polydipsia: Of the 100 patients in the series, 62 demonstrated no polyuria and polydipsia in contrast to 8 with the presence of both of these symptoms. Figure 9 depicts the glucose tolerance patterns of both of these groups. Five points deserve consideration. In the first place, the symptomatic group demonstrates a relative decrease in glucose tolerance. Secondly, the smallest mean difference is observed at the 30 minute interval. Thirdly, the greatest mean difference can be noted at the two-hour period. Fourthly, the three-hour levels are different for the two groups. In the asymptomatic group, the three-hour level is below the initial level. In the symptomatic group, the three-hour level is above the findings observed initially. Fifthly and lastly, it is clear from Table 2 that there is no statistically significant difference at any time interval.

Polyphagia-Polyuria-Polydipsia: Fifty patients did not report the presence of polyphagia, polyuria, and polydipsia while three did indicate that all three of these symptoms were present. Figure 10 depicts the glucose tolerance patterns of these two groups. Five points deserve special consideration. First, the symptomatic group demonstrates a relative decrease in glucose tolerance. Secondly, the smallest mean difference is observed at the fasting level.

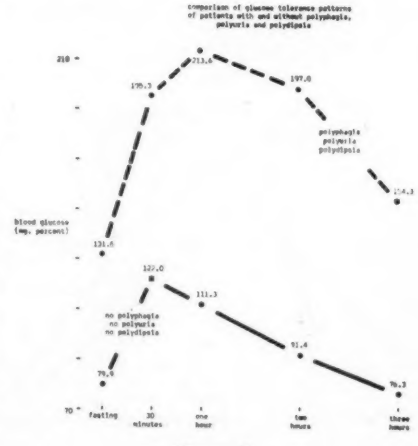
comparison of glucose tolerance patterns of patients with and without polyphagia, polyuria and polydipsia
blood glucose (mg. percent)
fasting
30 minutes
one hour
two hours
three hours
polyphagia polyuria polydipsia
no polyphagia no polyuria no polydipsia

Figure 10

Thirdly, the greatest mean difference can be noted at the two-hour period. Fourthly, the three-hour levels are different for the two groups. In the asymptomatic group, the three-hour level is below the initial level. In the symptomatic group, the three-hour level is above the findings observed initially. Fifthly and lastly, it is clear from Table 2 that there is a statistically significant difference at every time interval.

DISCUSSION

The data will be analyzed in three different ways: (1) a group analysis by comparison of the findings by Mosenthal and Barry with those observed in this study, (2) a subgroup analysis on the basis of symptomatology, and (3) a discussion of the age factor as it relates to blood glucose and extraoral symptoms.

GROUP ANALYSIS

It should be recalled that the present standards for the normal glucose tolerance curve include a fasting blood glucose less than 100 mg. percent, no blood glucose level greater than 150 mg. percent, and a return to below 100 mg. percent in two hours. On the basis of these criteria, two possibilities can be entertained. If all of the above specifications must be met for normal or abnormal glucose tolerance, then the dental patients in this survey cannot be regarded as systematically healthy. This conclusion follows from the fact that significant differences between the Alabama and Mosenthal and Barry groups were observed at the two-hour period (Table 2 and Figure 3). If, on the other hand, normality and abnormality are to be judged on the basis of specific blood glucose criteria, then the dental patients must be regarded as either well or ill depending upon the specific yardstick employed. For example, on the basis of the fasting, 30 and 60 minute findings, the dental patients meet the specifications for normality. However, utilizing the two-hour determinations, the dental patients satisfy the requirements for systemic illness.

SUBGROUP ANALYSIS

It is noteworthy that, with regard to single complaints, polyphagia, polyuria, and polydipsia do not delineate the diabetic from the normal patient. This is in contrast to the findings in an earlier report[1] in which it was demonstrated that stomatopyrosis appears to make this delineation.

The observations with combinations of two of the symptoms are also enlightening. One observes no significant differences between polyphagia-polydipsia versus no polyphagia-no polydipsia and polyuria-polydipsia versus no polyura-no polydipsia as demonstrated in Table 2. With respect to the analysis of those patients with polyphagia-polyuria versus no polyphagia-no polyuria, it can be observed that a significant difference exists in the fasting blood glucose determinations. It is noteworthy that the symptomatic group (polyphagia and polyuria) showed a mean fasting blood glucose of 98.7. This value, according to the Mosenthal and Barry standards, is regarded as within normal limits.

A restudy of an earlier publication[1] shows that those individuals with xerostomia and stomatopyrosis showed a significant difference in blood glucose levels at the 30 and 60 minute and two-hour points as compared with those patients without dry mouth and burning mouth. Thus, once again, the evidence suggests that *oral* symptoms may be a more delicate barometer of glucose metabolism than *extraoral* symptoms.

The data derived from the combination of all three extraoral symptoms are particularly revealing. One can observe (Table 2) that the symptomatic and asymptomatic groups differ significantly at all temporal points. This is in contrast to the findings with respect to intraoral symptoms where significant differences occurred only at the fasting level, 30 minute and two-hour points. Further, mention should be made that the symptomatic group with extraoral symptoms showed, according to Mosenthal and Barry, diabetic blood glucose levels at

Figure 11

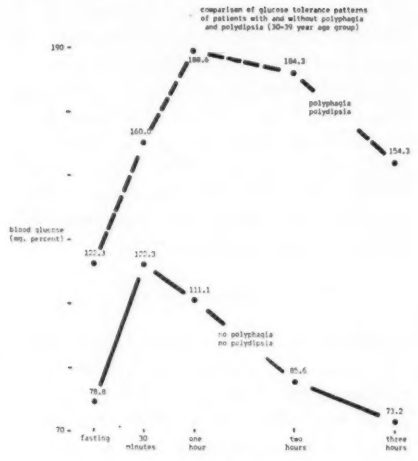

Figure 12

every temporal point. In contrast, this was not true with respect to oral symptoms.

AGE FACTOR

There are some investigators who contend that blood glucose levels are higher in the older age groups and that this is to be regarded as evidence of normal glucose metabolism. There is no disagreement that diabetes mellitus occurs predominantly in the autumnal years of life. Finally, it can be readily demonstrated that symptoms of the nature of polyphagia, polyuria, and polydipsia occur largely in older individuals. Therefore, the question which must be answered is whether the relationships which have been discussed in this report are true or whether they are complicated by the age factor. Accordingly, a restudy was made of those individuals with and without polyphagia, polyuria, and polydipsia. However, the data were collected within one age group so as to eliminate the age factor. Figures 11 and 12 show the glucose tolerance patterns for the symptomatic and asymptomatic patients in the 30 to 39 year age group on the basis of the combination of polyphagia and polyuria and polyphagia and polydipsia.

It is clear from these two figures that the overall mean pattern is essentially that observed in earlier illustrations. For example, the symptomatic groups show a tendency toward decreased glucose tolerance. However, it is also interesting to note that the asymptomatic groups do not show higher blood glucose levels within this age group than was previously observed for all age groups. This is one more point of evidence that *normal* glucose values in the aged are not higher than they are in younger groups.

TABLE 3

statistical comparison of mean differences in the 30-39 year age group

		blood glucose differences				
		fasting	*30 minutes*	*60 minutes*	*2 hours*	*3 hours*
polyphagia-polyuria versus no polyphagia-no polyuria	mean difference	32.000	26.000	45.000	64.000	67.000
	P	> .400	.500	.500	> .400	> .200
polyphagia-polydipsia versus no polyphagia-no polydipsia	mean difference	44.000	38.000	78.000	99.000	81.000
	P	> .200	.500	> .400	> .400	> .400

An examination of Table 3 discloses that at no point are the differences statistically significant. It is interesting to compare these findings with that reported in an earlier publication[1] where oral symptoms were analyzed in a fashion similar to the analysis of extraoral symptoms in this report.

It would appear from the evidence observed here and a comparison of these data with that for oral symptoms, that oral symptoms (xerostomia, stomatopyrosis, and gingival tenderness) are more delicate indices of carbohydrate imbalance than the classical and well popularized polyphagia, polyuria, and polydipsia.

SUMMARY

1. On the basis of the overall glucose tolerance pattern, 100 routine dental patients appear normal if judged by the standards for glucose established by Mosenthal and Barry.

2. On the basis of the 2-hour determination in the glucose tolerance pattern, 100 routine dental patients would be regarded as systemically abnormal.

3. On the basis of subgroup analyses of independent extraoral symptoms, neither polyphagia, polyuria nor polydipsia appear to be related to diabetes mellitus. This is in contrast to a similar analysis of oral symptoms where it was found that stomatopyrosis delineates patients with normal and abnormal glucose tolerance patterns.

4. The combination of polyphagia, polyuria and polydipsia, when compared to the glucose tolerance pattern, does not delineate the diabetic from the nondiabetic individual. In contrast, the combination of stomatopyrosis and xerostomia seems to separate the diabetic from the nondiabetic glucose tolerance pattern.

5. The constellation of polyphagia, polyuria and polydipsia appears to be very representative of decreased glucose tolerance. In comparison with the combination of xerostomia, stomatopyrosis, and gingival tenderness the extraoral symptoms are more representative of a disturbance in glucose metabolism than is the triad of oral symptoms. However, the patterns for oral and extraoral symptoms are essentially the same. Therefore, it appears that the oral symptoms can also be used to distinguish normal and abnormal glucose tolerance patterns. Moreover, the patterns derived from the intraoral symptoms are more delicate indices of the glucose tolerance pattern.

6. Within the limits of this study, the evidence suggests that the age factor does not play a role in the relationship of extraoral symptoms to the glucose tolerance pattern.

7. A series of reports to follow[14,15,16] will analyze a number of oral *signs* (commonly associated with the diabetic state) and glucose metabolism.

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Book Review . . . .

General Anesthesia in Dental Practice—Leonard M. Monheim. *First edition, 461 pages, 114 illustrations, 26 tables, The C. V. Mosby Co., 1960, St. Louis, Missouri, price $10.50.*

If a textbook could be a substitute for years of clinical experience in anesthesiology this book would be it! Dr. Monheim and his contributors have created a literary miracle by presenting complete information in all phases of anesthesiology. There are no unnecessary words in this work, every statement and illustration carries the impact of practical knowledge in a manner to excite comprehensive study.

Although the entire twenty chapters, appendix, and glossary are germane to anesthetists, several chapters render the book valuable to all dentists regardless of their interests in anesthesiology. Those covering the anatomy and physiology of respiration, circulation, and the nervous system; along with chapters discussing the "phases, stages and signs," agents and drugs, the evaluation of patients, postanesthetic care, and emergencies, all present facts usable in everyday practice.

This text is so easily read that studious practitioners will enjoy studying data giving the theory of physics, definitions, methods of administrations, modes of action, choice of agents, techniques, charting, and maintenance of airway. Of particular interest to those treating children is the chapter "Anesthesia for dental procedures in the pediatric patient." The beginning practitioner will derive good guidance from the chapters covering the legal aspects of general anesthesia, armamentarium, the technical aspects of anesthesia, anesthetic complications, and hazards.

In the appendix will be found useful charts for normal values, abbreviations, drugs, dosages and diagnostic tests. (On page 441 in reference to ⅓ gr. the equivalent should be 20 instead of 30 mg.). The author can be proud of this excellent text.

R. S. P.

Erythema Multiforme Exudativum (Stevens-Johnson Syndrome) Treated with Gamma Globulin

by EVERETT C. CLAUS, D.D.S.,* *Denver, Colorado*

HEBRA,[1] in 1866, used the term "erythema multiforme exudativum" to describe a mild systemic disease of unknown etiology characterized by pleomorphic skin eruptions. Four years earlier Bazin[2] had noted a similar syndrome associated with stomatitis and conjunctivitis. In 1922, Stevens and Johnson[3] reported 2 cases of a similar but more severe disease, in which there was a dramatic onset of fever, conjunctivitis and cutaneous eruptions. Illnesses like these have been described by such names as ectodermatosis erusiva pluriorificialis, erythema multiforme exudatorum, dermatostomatitis and erythema bullosum malignans.

In 1950, Robinson and McCrumb[4] pointed out the similarities in the clinical pictures of these diseases and grouped them collectively as the "mucocutaneous-ocular syndrome." Nevertheless, the terms "Stevens-Johnson syndrome" and "erythema multiforme exudativum" have become the most common today and are used synonymously. The difficulty in arriving at a satisfactory nomenclature is in part a result of the broad range of signs and symptoms, the wide variation in severity and prognosis that patients with this syndrome present and the tendency of earlier investigators to name such diseases by the appearance of the v[illegible]lesions. In an attempt to clarify [illegible] point further, Ashby and Lazar[5] suggested that the more severe types be called major and the less severe types minor.

The case reported here describes the clinical course of a negro male whose symptoms were compatible with those symptoms described as the Stevens-Johnson syndrome.

History of Present Illness:—This was the first Denver Veterans Administration Hospital admission of this 38 year old negro male who came in because of a painful rash on hands and feet and a sore mouth of several days duration. Upon admission the patient stated that he had been in excellent health and that there was no history of serious illness in the past. He also stated that he had been working actively since being discharged from the service and was perfectly well until about one week prior to admission when he first noticed several small, tender blisters or sores inside the mouth. The next three or four days the number of the sores increased and appeared in the roof of the mouth, under the tongue and on the gum. These blisters broke leaving ragged sores that were very painful. At this same time he felt weak and tired and was unable to eat any food at all. About three days prior to admission, he developed sore feet and noticed spots of redness on the soles of his feet and the palms of his hands. These spots enlarged and spread and became a rash which was so painful that he could not walk or use his hands very well. He further stated he had eaten practically nothing and that he had lost about 20 pounds of weight.

Past History:—The patient has worked as a construction laborer most of his life. He was in the Army from 1942 to 1949. He smokes about one package of cigarettes per day. He has no significant family history. He has no known allergies and has taken no drugs in the past year.

Physical Examination:—On admission the patient was found to be a well developed, well nourished negro male who was in extreme pain because of sore mouth and soles of his feet. The temperature was 99.1°. The other physical findings were within normal limits with the exception of the mouth which was quite striking with shallow ragged ulcerations involving the buccal mucosa, palate, tonsillar pillars, the tongue, the lips and the gingiva. The oral hygiene was very poor and there was marked periodontitis. The genital examination revealed an uncircumcised male with ulcerations about the tip of the foreskin; the glans penis was diffusely reddened but had no ulcerations. There was a milky white exudate coming from the urethra. There were pleomorphic, erythematous, maculopapular lesions of a purplish, hemorrhagic appearance on the palms of the hands and soles of the feet.

All laboratory tests were essentially within normal limits except the white blood count which was 12,300; and the sedimentation rate was high. All other diagnostic tests proved to be within normal limits.

Treatment:—After the clinical examination it was evident that this patient was

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suffering from Erythema Multiforme Exudativum. The diagnosis established, the patient was moved to the Dental Service for treatment. A thorough debridement was accomplished by instrumentation and repeated irrigations with Hydrogen Peroxide and water. Dobell's mouth wash was prescribed hourly. No other medication was used for the ulcerative stomatitis. Patient was returned to the ward and immediately given 20 cc Poliomyelitis Immune Globulin (Human),* 10 cc intramuscularly into right and left gluteal muscle. The patient received a liquid (fortified) diet and no other medication.

Hospital Course:—The following day the patient was only slightly improved but the second day, 48 hours following the injection of Gamma Globulin the patient was much improved and it was noted that the oral lesions were less uncomfortable, they were smaller and there was a definite sign of healing. The fifth day all lesions were healed and the patient was asymptomatic.

DISCUSSION

Diagnostic Symptoms:—Ulcerative lesions of the Oral Mucous membrane have been variously designated as fever blisters, cold sores, canker sores, herpes simplex, herpes labialis, recurrent aphthae, recurrent aphthous stomatitis, herpetic gingivostomatitis, periodenitis mucosa necrotica recurrens, Stevens-Johnson syndrome and Behcet's syndrome. Practically all authors agree that herpetic gingivostomatitis is caused by the herpes simplex virus. There are many who designate other ulcers as aphthous stomatitis or recurrent aphthous stomatitis and believe these to be non-infectious and of unknown origin or etiology.

Erythema multiforme exudativum (Stevens-Johnson syndrome) is an eruptive disorder of the mucous membranes and skin with an acute systemic reaction. The onset is usually abrupt and is accompanied by fever, malaise, headache, sore mouth and sore throat. The constitutional symptoms become more severe, and ulcerative stomatitis and conjunctivitis ensue. Within a few days the dermatitis appears, being characterized by pleomorphic, erythematous, maculopapular lesions usually having a purplish and hemorrhagic appearance. Vesicles or bullae containing clear fluid appear in the center of such lesions, which later rupture and are followed by a crusted, hemorrhagic appearance. These lesions are usually discrete but may become confluent, especially around the mouth and nares. With the exception of the scalp, the entire body is often involved. Furthermore, lesions in various stages of development may be seen, in contrast to the single crop of eruptions as seen in smallpox. Because of the resemblance of the syndrome to smallpox the two may be confused. A dramatic example of this occurred in July, 1956, at the small farm community of Crescent, Oklahoma. The entire population of 1341 residents was placed under quarantine because a case of erythema multiforme in a young boy was misdiagnosed as smallpox.[6]

The mucosal lesions are frequently painful, and tube feeding may be required. The stomatitis is characterized by vesicles, which appear on the lips, tongue, buccal mucosa and pharynx. Upon the rupturing of the vesicles a grayish-white pseudomembrane forms that sloughs and is followed by bleeding and hemorrhagic crust formation. The conjunctivitis is usually bilateral and initially mucoid but later mucopurulent, with necrotic membrane formation. As a sequel, corneal scarring and permanent blindness may occur. Most male patients will have evidence of urethrobalanitis, whereas in females a vulvovaginitis, with severe dysuria and urethral discharge are often found.

Etiology:—At present no single etiologic agent has been found for all cases. Food allergies, drug hypersensitivities (especially those resulting from aspirin, barbiturates and sulfonamides), toxin producing bacteria and virus have been suggested as possible causative agents. The nature of the

*The Gamma Globulin (Poliomyelitis Immune Globulin [Human]) was supplied through the courtesy of Merck, Sharpe & Dohme Research Laboratories, West Point, Pennsylvania.

lesion and the marked systemic manifestation has led current interests to be centered on the theory that erythema multiforme is of infectious origin. Viral rather than a bacterial etiology seems more probable since numerous attempts to isolate specific bacteria have been inconclusive. The isolation of the "Herpes Simplex Virus" from a patient with "erythema multiforme exudativum"[6] supports this theory.

Treatment:—The similarity of the clinical appearance of the lesions in Herpetic gingivostomatitis and erythema multiforme exudativum; the unknown etiology of the latter; the successful treatment of oral herpetiform lesions with Gamma Globulin by the author and the treatment of herpetiform lesions with Gamma Globulin as reported by Strean, Williams and Pritchard[7] and Ramfjord,[8] the author hypothesized that the use of Gamma Globulin in the treatment of erythema multiforme exudativum was worthy of trial. Such a case is herein reported. The dramatically rapid improvement of this patient following the treatment with Gamma Globulin leads one to believe that this treatment may have considerable merit. One realizes that reporting the successful treatment of one case is inconclusive evidence that this should be the accepted treatment in all cases of ulcerative stomatitis; yet, the author's observations should certainly be of sufficient importance to recommend the use of Gamma Globulin in all cases of ulcerative lesions of the oral cavity of suspected viral origin. Certainly the report of this case warrants the recommendation of this treatment for similar cases in the hope that it will stimulate further observation and study. The reaction and findings of other investigators will be of great interest.

SUMMARY

The etiology of erythema multiforme and the mechanism involved in the disease process remains obscure. Traumatic, physiological or severe emotional stress is believed to play a role in the etiology of this condition, presumably by interference with local tissue immunity and production of environment conducive to vesicular formation by release of intracellular virus. Since Gamma Globulin is known to contain antibodies against many bacteria and viruses, an attempt was made to test and evaluate the therapeutic value of Gamma Globulin in the treatment of a case of erythema multiforme exudativum. The results in this one case were sufficiently encouraging to warrant further clinical trial and observation.

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Idiopathic Fibrous Hyperplasia of the Edentulous Maxillary Ridges

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THE high frequency of incidence of enlargements of the "gums" and their importance in diagnosis and therapy has led, in recent years, to careful analysis of recorded cases and of routine clinical experience with the result that there is a substantial agreement as to the broad categories under which enlargements may be classified. Older terms have been found somewhat confusing; for example, it is recognized that the commonly employed term "hypertrophy" of the gums is, probably, in the strict interpretation of the term, a misnomer since the phenomena of true hypertrophy, histologically speaking, have not been observed in these tissues. As an overall term it has been found helpful to use the very inclusive word of "enlargements" in order to avoid confusion and to permit comprehensive classification.

Currently used classifications, such as the excellent categorizations of those of Glickman,[1] Burket,[2] Rushton,[3] Hine,[4] etc., differ to some degree in structure, but clearly separate the inflammatory and traumatic factors from conditions in which systemic influences are determinative (endocrine disturbances, blood dyscrasias, nutritional or drug-related states, etc.) and recognize a relatively uncommon but significant group of enlargements of idiopathic and perhaps hereditary nature. These are variously termed—idiopathic hyperplasia of the gums—idiopathic diffuse fibromatosis of the gums—diffuse non-inflammatory hyperplastic enlargement, etc. The present discussion will deal with this type of enlargement.

Other terms which have, in the past, been employed would include "elephantiasis of the gingivae or of the ridges," "gigantism of the dental ridges," "palatal fibroma" (sometimes termed "symmetrical palatal fibroma" in cases of marked bilateral involvement), "fibrous enlargement of the tuberosities."

Among the published records of cases, well over one hundred instances have been noted in dental literature, which, in spite of various descriptive terms employed, would seem to belong, in most instances, to this broad general category. However, there are a number which would actually seem to fall more appropriately into other categories. It may justifiably be assumed that some of the recorded cases represent intraoral manifestations of multiple neurofibromatosis (molluscum fibrosum). The developmental anomaly of unilateral enlargement of the facial structures would seem to offer an explanation for some reported lesions, the hemifacial enlargement having been, seemingly, misinterpreted. Further, the ubiquity of some evidence of inflammatory phenomena in the mouth facilitates confusion between lesions of essentially inflammatory origin and other enlargements which are relatively free of inflammatory dominance in the histologic picture. Obviously, in cases of such nature as to favor food retention, frictional irritation, etc., secondary inflammatory changes are to be anticipated; and, these may complicate the categorization of the lesion.

Many published cases, therefore, do not clearly differentiate, in description or in etiologic discussion, between lesions which are primarily of inflammatory origin and those which, in addition to obvious inflammatory sequelae, show evidence of basic idiopathic factors.

Diffuse enlargement of the soft tissue may occur around the teeth in instances of full or partial dentition; on in edentulous areas whether the arch is completely or only partially edentulous.

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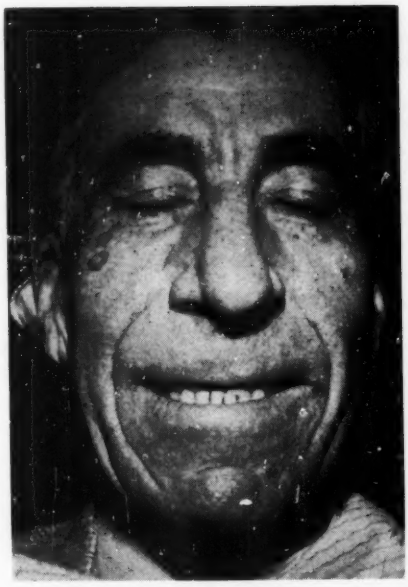

Fig. 1. Photograph of Patient J. V., age 60; prior to removal of growths.

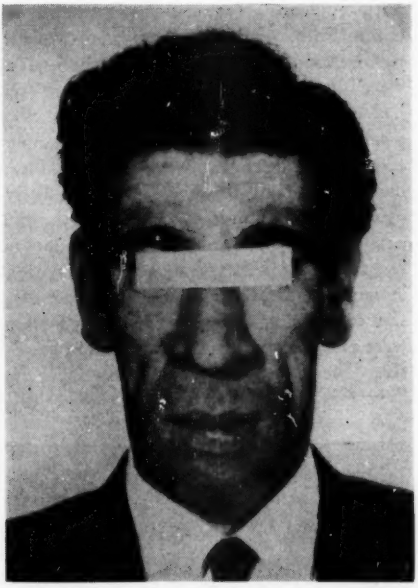

Fig. 2. Case of Dr. M. A. Rushton (Dental Practitioner), VII/5, January '57; Note facial characteristics comparable to those seen in Fig. I.

Thoma[5] claims that bilateral involvement of the tuberosities is not uncommon, even to the obliteration of the palatal vault. We would question the use of the term "not uncommon." The literature would seem to indicate that its occurrence and recognition are relatively rare. It must, of course, be obvious that, in all probability, many instances of such lesions are never recorded. Further, analysis of reported material suggests that some 50% of the cases on record have been presented by medical practitioners. For them the difficulties of classification and analysis would be substantial and the identification of types would be problematic. On the whole, the literature as well as current experience would seem to indicate that the occurrence of the lesion, its recognition and reporting is relatively uncommon.

Reviewing the cases on record, it is noted that not more than ten of such reports appear to present characteristics fully consonant with the lesion now under discussion.

It will be of interest to point out that a similarity of facial characteristics was observed in relation to the first illustrative case to be presented and to an individual studied by Rushton. (Fig. 2) Such physiognomonic resemblance may, of course, be purely fortuitous and non-significant as to typal characteristics but its occurrence is perhaps worthy of record.

ILLUSTRATIVE CASE HISTORY

The patient, J. V., male, age 60, (Fig. 1) a teamster, was referred to the authors at the U.C. clinics with the chief complaint of massive thickening of palatal tissue; bilateral pads of yielding fibrous tissue covering posterior maxillary ridges and extending medially to the vicinity of the midline. The patient was desirous of surgical care in the hope of removal of the masses making denture construction possible.

Clinical and radiographic examination revealed the presence of two upper cuspids, one central incisor, with three pontics attached to the cuspids. A root-tip of the upper left second bicuspid was also present,

with evidence of apical involvement. In the mandible, anterior teeth were present to the 2nd bicuspid region; but the molars were bilaterally absent. No partial dentures had even been worn. Clinically, there was a soft fibromatous thickening of the upper edentulous ridges, with semi-firm, yielding, non-hemorrhagic tissue projecting medially over, but not in direct contact with, the palate and to such a degree that the opposing sides approximated with an intervening irregular separation. (Fig. 3) Clinically, the surfaces of the massive overgrowths were moderately keratinized and non-sensitive. The lower jaw was uninvolved in the hyperplastic change. (Fig. 4).

Fig. 3. Photograph of lesions of upper jaw of patient J. V.

The patient was psychologically unconcerned regarding the growth, his major complaint being inability to properly masticate food of fibrous nature.

RELEVANT HISTORY

To the limits of memory he recalled having, in childhood, swelling of the gums around the teeth. In this regard he refers to the permanent teeth, since he has no recollection of the character of his deciduous dentition. He does recall that his permanent teeth erupted tardily. The swelling continued through adolescence and was noted at the time of his marriage. At this time also a physician observed the enlargements on the occasion of an attack of influenza. During the period of World War I he had surgical removal of the upper posterior teeth since (1) periodontal disease had developed, involving anterior and posterior teeth and (2) the posterior teeth were also attacked by dental caries. He believes that maximal enlargement was reached at the time of extraction of the third molars, circa 1930. At no time was he able to have dentures constructed because of the bulky enlargements. No photographs during this lengthy period were taken. Finally, he was referred for treatment as above indicated. He was in full agreement when surgical excision of the bilateral masses was recommended.

OPERATION AND THE SECURING OF SPECIMENS

In two unilateral operations the fibrous masses were removed in toto, the area of removal extending anteriorly to the distal of the cuspid region. The large specimens (ca. 4.5 × 3.5 × 3.5 cm) (Fig. 5) were processed histologically.

Healing was rapid and uneventful. Subsequently, his dentist removed his remaining upper and lower anterior teeth; and full dentures were constructed. The upper denture has been continuously satisfactory without adjustment (Fig. 8); and after three years he reports ability to masticate all types of food. He is not conscious of any sense of crowding of the ridges or of any other source of discomfort. His lower denture was, by prearrangement, remade after one year and has been fully satisfactory.

PATHOLOGIC PICTURE

Gross. The overall mass of the specimen from each side of the posterior upper arch consisted of a roughly rectangular, rounded oval mass of moderately firm but resilient tissue, approximately 4.5 cm in antero-posterior length, 3.5 cm in latero-medial width and 3.5 cm. in height. Relatively flattened on the occlusal surface and indented by only an occasional superficial diagonal groove it showed anteriorly, on

Fig. 4. Cast of lower jaw of patient J. V.

each side, a sharply curved contour, leaving the height of the surface plane at a distance of 6 to 8 mm distal to the remaining teeth (cuspid on right side, first bicuspid pontic on left side)—at which border the tissue mass was thinned to minimal thickness—and sweeping medially toward the midline and palatally toward the high palate floor. The medial border, bilaterally, while loosely covering the bulk of the palatal surface, was free and unattached in its outer 4-5 mm; this border could be readily moved by the palpating finger, although, as indicated above, the texture was of moderate firmness. The aperture, between the opposing sides of the right and left masses, revealed the palate midline to a width of ca 12 to 15 mm anteriorly and posteriorly to a width of ca 9 mm in the area of maximal approximation. The surface of each mass was smooth and seemingly well protected from injury by a keratinized epithelium. Signs of inflammatory change were absent or minimal in extent (Fig. 3).

Fig. 5. Gross photograph of tissue removed from left side of posterior arch (circa 4.5 x 3.5 x 3.5 cm).

HISTOPATHOLOGIC

Overall: The mass of the specimen consisted of well organized and differentiated collagenous tissue of mature structure and texture. Vascular supply was relatively limited as were cellular elements. Surface inflammatory involvement was markedly slight (Fig. 6).

The epithelial covering was somewhat acanthotic exhibiting areas of moderate hyperkeratosis and contiguous areas of parakeratosis suggestive of relative intraoral surface stresses. The inner border of the epithelial layer was rather irregular, with narrow and tortuous but fairly short rete pegs interspersed with broader-based rete pegs (see Fig. 7). The basal layer showed good overall cohesiveness and polarity. This layer and the adjacent prickle cell layers were on the whole uniform in cell dimensions, nuclear size and staining and in intercellular bridges. Vacuolization was not an outstanding phenomenon. The granular layer was prominent, especially beneath the zones of hyperkeratosis. Certain areas of the surface were subjected to more traumatization and showed slightly longer rete pegs, slightly increased inflammatory reaction and lesser degree of keratinization; however, these differences were not pronounced.

No substantial evidence of mucoid degeneration was found, following the use of specific staining. Sporadic areas with some fragmentation of fiber structure suggestive of slight change of this nature was noted. (This change has been found in more abundant degree in cases described by other investigators.)

Multinucleated giant cells were not observed. Fibroblastic proliferation was not noteworthy. Foci of calcification were scanty but observable in the deeper portions of the mass. Histopathologically, the

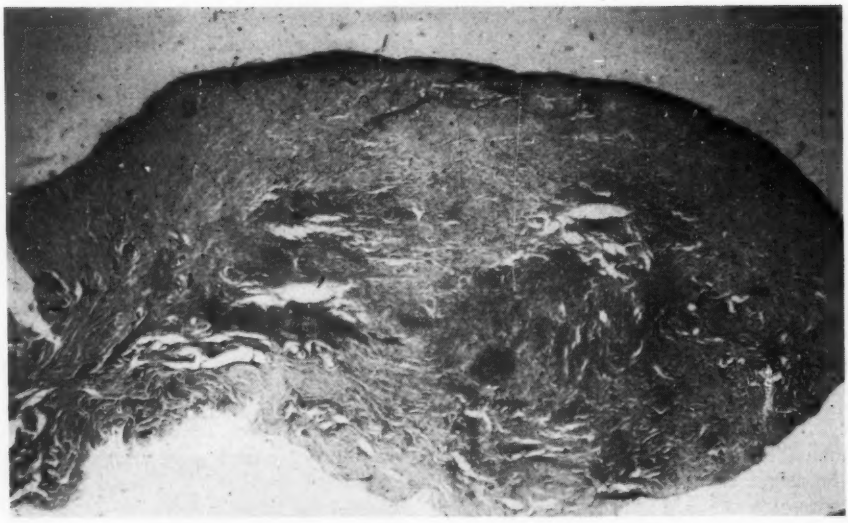

Fig. 6. Photomicrograph, low power, of lesion shown in Fig. 5.

status of the tissues examined would appear to be compatible with the use of the term—idiopathic fibrous hyperplasia.

FURTHER ILLUSTRATIVE MATERIAL

In another case recently made available to us through the courtesy of a departmental colleague, Dr. Joe Frisch,[6] a patient showed a clinical history essentially comparable to that in the case above described. While the over-all distribution and the contours of the lesion did not equal the dimensions of the condition which has been described in detail, there was a marked consonance in the characteristics of the clinical picture.

Covering the mass of fibrous tissue the intact epithelial tissue showed a moderate degree of acanthosis. There was good overall polarity; some degree of surface keratinization and a distinct but limited keratohyaline granular layer. The rete peg pattern was relatively even in length, some extensions blunt, some sharply patterned.

The connective tissue configuration displayed areas of coarse wavy bundles, others of loose, diffuse character and interlacing zones of moderate density. In certain regions cellular disparity was noted; in others many flattened fibrocytes could be identified. Vascularity was relatively limited and, in portions of the specimen, was scanty. Endothelial cells lining the vessels again demonstrated variation, in different areas, from plump to flattened contours. Occasional nerve tracts were noted perivascularly. In scattered areas, some located perivascularly, zones of non-extensive chronic inflammatory cellular reaction were observable (Fig. 9).

Special staining, with regard to possible areas of mucoid change, was negative.

DISCUSSION

The essential nature of the tissue response under consideration has been a source of considerable speculation and of variant hypotheses.

Some years ago Stärke drew attention to the clinically observable variations in tissue response to various stimuli. He recognized three types—a) Hypoplastic-hypotonic mesenchymal type—characterized by: loose, wide-mesh tissues; by decreased functional capacity and diffusibility; by slow reaction to stimulation. b) Hyperplastic-hypertonic

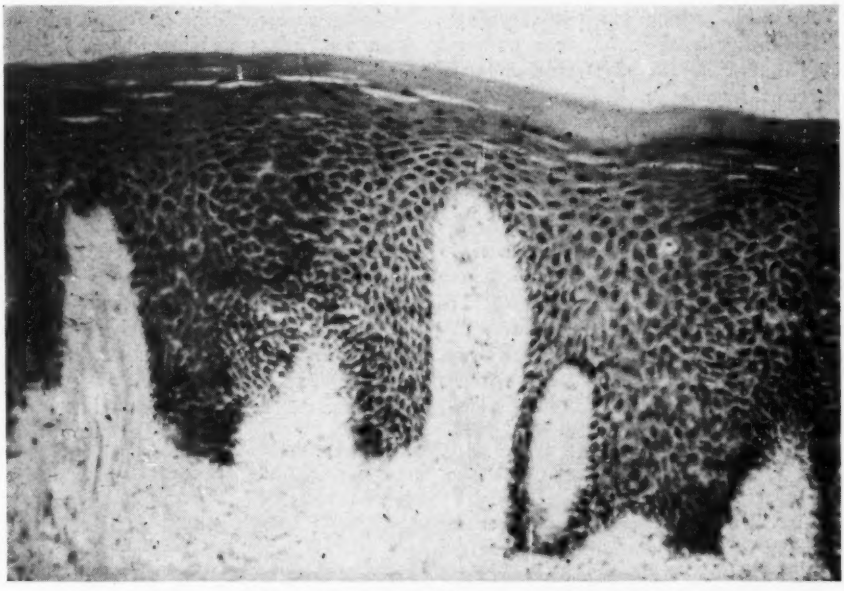

Fig. 7. Photomicrograph of portion of epithelial border of lesion shown in Fig. 6.

mesenchymal type—characterized by: fine tissue texture; by increased functional capacity; by rapid response to stimulation; but—easily fatigued and with a tendency toward tissue hyperplasia. c) Intermediate type or types. This emphasis was suggestive of commonly noted differences in gingival or other mucous membrane behavior following simple injury—variations from a tendency toward a destructive or atrophic response to a response characterized by productive phenomena (with, of course, many intermediate gradations). However, this approach did not relate definitely to a phenomenon of response observed only in one localized area or organ.

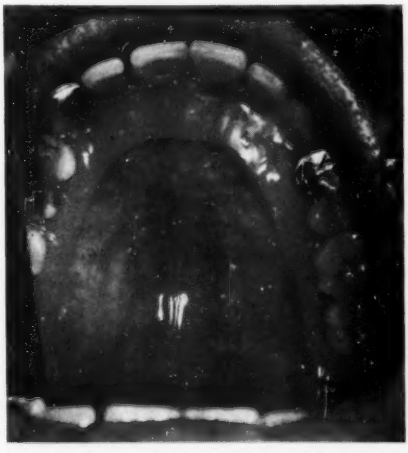

Fig. 8. Photograph of upper jaw of patient J. V., following surgery, healing and denture construction.

Fig. 9.
Case No. 2. Patient of Dr. Joe Frisch. Dimensions of section—6 x 9 mm.

A tenable position which is increasingly shared by pathologists has been expressed by Rushton[3] to the effect that since the abnormal response can be partial and localized (as in solely unilateral involvement) the abnormality may well be expressed in the constitution of the affected part, rather than representing any systemic abnormality of the organism as a whole. Related to this concept are contemporary references in dental literature such as, for example, the use of the term "inherited dental inferiority." In the use of this nomenclature observers have suggested that, in early life, such a condition may show no effects unless external or functional injuries are added; but that, in later life, this "condition" may show up dramatically in tissue atrophy, for example, senile or presenile atrophy.

Attention has, in recent years, been repeatedly directed toward the manifold ramifications of the "stress phenomena" and of "adaptation syndromes," as developed by Selye[7] and others. An important derivative emphasis in this area (which may be pertinent to the above mentioned concepts) is now being placed on the phenomena of regional adaptation as distinct from general adaptation. Bernier[8] has focused attention on periodontal applications of this concept. Its validity in the rationale of idiopathic fibrous hyperplasia of the edentulous ridge is worthy of serious consideration.

SUMMARY

Clinical material has been presented showing characteristics of the condition known as "Idiopathic Fibrous Hyperplasia." The search for possible etiologic factors has been given consideration; and problems of terminology and classification have been discussed. Recent advances in the understanding of the biologic phenomena related to the connective tissues may offer further enlightenment in the comprehension of lesions of this nature. Of particular pertinence may be the interest recently focused on the mechanisms of regional adaptation to stress; and further study of these changes in contradistinction to the more widely recognized phenomena of generalized character may be rewarding.

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UNIVERSITY OF WASHINGTON

The University of Washington School of Dentistry offers four teacher training fellowships in periodontics for the school year beginning September 1960. Additional information may be obtained from Dr. Saul Schluger, Graduate Dental Education, University of Washington, Seattle 5, Washington.

The Status of Temporary Fixed-Splinting Procedures in the Treatment of Periodontally Involved Teeth

by IRVING B. STERN, D.D.S.,* *Seattle, Washington*

IT IS a simple matter to make a treatment plan for a patient whose periodontal condition is obviously either manageable or hopeless; it is quite another matter to make a definitive decision when the prognosis is questionable. Assuming that the patient would prefer to attempt to salvage his dentition rather than to ignore his condition or to submit to summary extractions and full dentures, it is possible to institute treatment and to defer final judgment. The agency for this postponement is the provisional splint. Through its use we may achieve stabilization which aids healing and facilitates normal masticatory function. This intervention may lead to success or the periodontal structures may progressively deteriorate. In any event, the final answer becomes apparent only with the passage of time.

Temporary fixed splints, therefore, occupy a unique position in total periodontal therapy. These splints are used in those seriously involved patients in whom one or more of several conditions prevail:

1) the teeth have loosened
2) missing teeth require replacement
3) one is uncertain of the tissue's response to treatment.

Since the outcome is uncertain and final splints require much time and effort, and are quite expensive, temporary splints may be used. These splints are both simple and economical, and provide a transitional reconstruction pending the return of the tissues to health. They could well be named observational, transitional, provisional, or diagnostic splints and all these names may be considered equivalent. In the broadest sense they refer to any appliance used to support periodontally involved teeth. They may be fixed to the teeth for periods of weeks, months, or years. They cannot be removed by the patient, but are removed by the dentist from time to time so that the teeth and the supporting tissues can be examined. Such splints are to be used either until the teeth become firm and can function without extra support, or until it is clear that the dentition, in survival, will require the help of a final periodontal prosthesis, or until the situation is hopeless and the teeth must be extracted.

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HISTORY OF SPLINTING

Current usages always stem from historical antecedants. The word splint was in use by the turn of the century. Burgess in 1915 used pinlays and pinledges as "Stabilizers for Loose Teeth."[1] Spies in 1912 wrote on "Splints in the Treatment of Pyorrhea Alveolaris."[2] Goslee in 1913[3] and Johnson in 1918[4] also referred to splinting. Ellander in 1918 coined the word, fixature, to mean a fixed splint.[5] Houston in 1909 wrote on "Immobilization as a Cure for Pyorrhea Alveolaris."[6] Burchard in 1895 used the banding technique for loose teeth.[7] Trueman in 1895 used vertical pinning.[8] Witkowski, whose work dated from 1896, reported on horizontal pinning in his book, "The Tightening of Loose Teeth" published in 1912.[9] By this date others were using soldered crowns and inlays.[8, 9] Andrews, 1882, Rhein, 1888, and Ottolengui, 1889 prepared grooves in teeth and stabilized them with heavy gold wire held by cement or gold foil![10, 11] Indeed, they made extensive splints and even retained facings in this way. They also used clasp-like bars which were fixed to the teeth by parallel pins inserted in the root canals. They were familiar with wire ligatures which they covered with "celluloid" cement for esthetic reasons. Litch in 1887 used combinations of posts and crowns to perform extensive bridgework[12] and gave due credit to de Chemant—1804, Gariot—1807, Delabarre—1820, and Maury—1828.

If one considers the variety of splints for loose teeth, the splinting inherent in extensive bridgework, the use of retainers following orthodontics and the use of fracture splints to set broken jaws, the historical review of dental splinting has understandably been left incomplete.

Moreover, much of this knowledge had in turn been handed down from still earlier days. Fauchard —1723 knew how to ligate teeth and could band

crudely,[13-14] and the Etruscans 8th Century B.C. to 1st Century A.D. utilized wire ligation, and small gold rings and bands to stabilize teeth.[15]

The splinting approach, therefore, rather than being new is very old. The broad implication of the survival of this therapy through the years is that it must work. Improvements and refinements in splinting have been brought about in materials and techniques, but always within the framework of a hereditary descent.

THE TYPES OF TEMPORARY SPLINTS

A variety of temporary splints (thus developed) are used in periodontal therapy today.[16-21] These have been classified as *removable* and *fixed*, and the fixed splints have been further subclassified as *provisional* and *final*. Generally speaking, removable splints have a limited value because they provide inadequate stabilization. The final fixed splints are essentially fixed bridges. These splints need not be discussed except to say that when one can be decisive it is best to enter into final fixed splinting. This paper is concerned with those instances where the decision to proceed with final splinting is not clear, i.e., with the provisional or temporary fixed splinting measures.

These temporary (provisional) fixed splints may be classified as: (1) *External devices* which are ligated or fixed to the intact tooth surface, and (2) *Intracoronal internal devices* which are bonded to cavity preparations in the tooth structure, and (3) *Circumcoronal internal devices* bonded to crown preparations.

1. *External Devices*
   a. wire ligatures
      1. gold, brass, or stainless steel wire without covering[22]
      2. stainless steel wire covered with self-curing acrylic[23]
   b. fixed orthodontic appliances[24]
   c. welded bands[25]
   d. cast metal continuous clasps[26]
   e. acrylic continuous clasp-like stabilizers[27]
2. *Internal Devices—Intracoronal (cavity preparation type)*
   a. internal rigid wires or staples embedded in a retentive substance
      1. acrylic[28]
      2. cement[10,11]
      3. amalgam[29]
      4. gold foil[10,11]
   b. pinledges, onlays, or inlays interlocked or welded in a series of units[1]
   c. horizontal and vertical pins and screws holding cast bars[30-32]
3. *Internal Devices—Circumcoronal (crown preparation type)*
   a. acrylic splints
      1. acrylic or epoxy resin alone[33]
      2. acrylic or epoxy resin alone on copper bands or cast copings[34,35]
   b. full crown, veneer crowns, three quarter crowns welded in a series of units[16,36]

PROPERTIES OF SPLINTS

An ideal temporary splint should have the following properties:

1. Ease and economy of preparation
2. Rigidity
3. Durability
4. Dimensional stability
5. Esthetic appearance
6. Close dimensional fit
7. Ease of removal and replacement
8. Ease of home care procedures
9. Cleanliness in design and function
10. Freedom from pulp irritation in preparation, use and placement
11. Freedom from irritation to the marginal gingiva

Obviously, no one material or method can encompass all of these properties. Hence, no one splinting method has superseded the others. Each method has its advantages and disadvantages.

ADVANTAGES-DISADVANTAGES OF TEMPORARY SPLINTS

1. *External Devices*

The external devices tend to be unesthetic and unhygienic. They lack durability, rigidity, dimensional stability and close

fit. The materials may stretch, warp, or may loosen and retention is poor. These conditions permit decay or, on occasion, cause the teeth to shift. The splints tend to break and generally do not last too long. Therefore, they must be replaced frequently. On the other hand, they are prepared easily and economically. They can be removed and replaced readily. They may cause gingival irritation, but cause no pulpal damage. Tooth structure is not removed and if the teeth become firm the device may be discarded.

2. *Internal-Intracoronal Devices*

The internal devices and splints have many of the same shortcomings. They are as serviceable as is their accuracy of fit coupled with the patient's susceptibility to caries. The materials tend to wear and break and are dependent upon the strength of the bonding medium. However, they are more rigid and durable than the external splints. They are not so easily removed or replaced. They are more difficult and expensive to prepare. They may be irritating to the pulp, and tooth preparation may lead to pulp involvement. Their retention often becomes a problem since only part of the occlusal surface is covered by the splint. Premature contacts on the uncovered surfaces tend to force loose teeth away from the splint which is held rigidly to the more stable teeth. This may frustrate the purpose of splinting and may also lead to further decay.

3. *Internal-Circumcoronal Devices*

Internal splints made of crowns tend to give the most lasting service. When a final reconstruction is anticipated, these splints may be used to obtain, to maintain, and to help transfer occlusal relationships. Missing teeth may be replaced and, hence, function may be restored to teeth without antagonists. Tooth form and position, the occlusal table as well as the occlusal plane, may be improved. The arrangements of adjacent and opposing teeth and between the arches may be altered. Once again the period of observation affords us the opportunity of gauging whether or not the patient's mental and neuromuscular adaptivity will accept these occlusal changes. With these aids the patient should be able to function in comfort during the fabrication of the final splints.

This same period of temporary splinting permits the pulp time to recover from the effect of the operative trauma and to form secondary dentin. Further benefits are gained by the pulp protectant qualities of the anodyne cement and tooth sensitivity tends to be minimized after tooth preparation. The risk of including questionable teeth is considerably less than it would be in a permanent appliance, since we have easy access to the teeth and the splint for purposes of treatment or modification.

There are disadvantages in that the crown preparations are made on periodontally involved teeth and the complications of extensive gingival recession, root indentations and open furcations harass the operator. There are operative pulp exposures. Margins and interproximal joints may impinge on the gingivae and cause inflammation and hyperplasia. Home care may become more difficult. The temporary cementing medium may break down and the splints may loosen. This may be evidenced by discoloration of the acrylic. Seepage beneath the splint may cause foul odor due to putrefaction and may also cause the teeth to decay. If the splint loosens on only one tooth these changes are insidious and may cause the tooth to be lost. When one area remains firmly cemented and another area loosens, a very damaging, spring-like, up and down motion may occur. Calculus deposition and periodontal inflammation may continue. Certainly the need for periodontal maintenance is not diminished. When materials wear and break, repair may become a problem. Some anodyne cements contain eugenol which can soften acrylic or keep it from setting. Therefore, a temporary cement that does not soften acrylic should be used. The use of metals is preferable when considering the problems that relate to wear and break-

age. Bruxism and clenching are particularly hard on splints. These actions cause the splints to loosen and break, and may even wear through gold crowns. On the other hand, there is a mitigating influence upon grinding, clamping, and clenching since the splints tend to resemble "built-in" night guards.

When the splints are removed or replaced extra caution must be exercised. Oblique forces may cause tooth breakage, and excess force may accidently extract a tooth with weakened support. The best splints are very rigid. A less rigid splint may be minutely bent during removal with the result that when it is replaced it will act as an orthodontic appliance and depress or shift the teeth. A bite opening effect can be produced if the temporary cement is not completely removed from the crowns before replacement. Similarly, all traces of temporary cement must be removed before repairing with acrylic. In reseating a splint care must be taken to reseat it accurately, otherwise the patient's occlusion may be disturbed and trauma may result.

Many of these disadvantages can be minimized if we use a final fixed splint. Such a splint may be utilized as a temporary splint by the simple expedient of using temporary cement as the bonding medium. However, such an approach is expensive because of increased treatment time and material costs. On occasion when the time comes to convert to the status of a final bridge it will be found that recession, caries, or esthetics have altered the situation and the splint must be redone.

THE CHOICE OF SPLINTING METHOD

Once the decision has been made to proceed with temporary splinting then one must select a splint. The specific advantages and disadvantages of the splints must be measured against the specific needs of the patient. Therefore, the choice of splinting method will vary from case to case with the degree of periodontal involvement, the importance the patient attaches to his dentition and the total evaluation of the case. The stakes involved become a significant factor in the decision. Is there the possibility that the teeth will become firm enough ultimately to function without a splint? If so, then it would be advisable to consider an external splint. Are there indications for extensive operative dentistry? Is it obvious that the teeth can never function without supplementary support? If so, then the use of an internal device which would then simultaneously deal with both of these problems is indicated. However, once an internal device has been decided upon and used, the patient is committed to a final periodontal prosthesis or to operative dentistry if the treatment succeeds. The patient must be made cognizant of this further requirement before undertaking treatment.

INDICATIONS FOR PATIENT SELECTION

How shall we decide if the patient's periodontal status indicates that a splint is needed? Mobility is the key symptom treated by splinting. There is no basis for the splinting of mildly involved teeth on a preventive basis. One may not justify splinting simply because of the presence of inflammation, or recession or occlusal disharmony. There are basic criteria for temporary fixed splinting, these are:

1. *Mobility*—if this mobility cannot be adequately reduced by any other therapeutic means.
2. *Positional Instability*—as evidenced by the drifting of teeth or presumed instability following the repositioning of such teeth.
3. *Missing Teeth*—where the remaining teeth are sufficient in number and adequate in distribution to serve as multiple abutments for a fixed or removable prosthesis which will replace these missing teeth.
4. *Diagnostic Need*—to ascertain whether therapy will or will not be successful.

Since this therapeutic area requires a full measure of understanding and patience on

the part of the patient, not all patients can be candidates for this approach. Cases should be screened carefully, selecting willing patients. Treatment should never be urged on dubious patients. Treatment should be delineated as observation and no rash promises should be made. Since the splinting is essentially a diagnostic procedure used on seriously involved teeth, the patient should be made aware that his tissues may not respond to treatment. The patient who is anxious to save his dentition will find reassurance in the fact that the dentist accepted the case and is making every effort. Although many neurotics are excellent dental patients, a degree of caution is suggested if it appears that the patient's peculiarity would hamper treatment.

FURTHER CONSIDERATIONS IN SPLINT AND PATIENT SELECTION[16–21]

The decision to splint and choice of the device depend upon the needs of the patient. How these needs can best be met will depend upon the answers to the following questions:

1. Are there bruxism, clamping, clenching or other situations which cause periodontal traumatism?
2. Are there tooth driftings, malocclusions and occlusal disharmonies that require correction?
3. Is the general pattern of bone loss, crown-root ratio, and tooth distribution such that the extraction of a single tooth might condemn the whole case?
4. What has been the tissue response to curettage and surgery? Does the comparison of roentgenograms over the last few years indicate a rapid or slow bone loss?
5. Is the age of the patient in keeping with the degree of breakdown?
6. Is there a need for restorative dentistry because of caries, erosions, abrasions, washing out of fillings, overhangs, open contacts, food impactions, areas of deep occlusal wear, sensitivities, or missing teeth?
7. Is the health of the patient sufficient to stand extensive treatment and is there sufficient life expectancy to make the endeavor worthwhile?
8. Is the patient's mental and emotional status adequate to the task and is his expectancy of therapeutic result realistic?
9. Are there needs that require an alteration of esthetic appearance of the patient's teeth? Are there unsightly migrations and recessions?
10. Are there adverse factors of high caries rate, rapid tartar deposition, poor home care and is the patient prone to gingival inflammation caused by irritation?
11. Is there sufficient attachment to hold a reconstruction?
12. Is there sufficient periodontal attachment to support a splint in function? If not, the splint may move as a unit and may thus lead to the exfoliation of teeth.
13. Can the above problems be adequately handled by any other means such as, minor tooth movement, occlusal adjustment, night guards, etc.?

The strategic value of each tooth and its possible contribution to the functioning dentition must be considered in every instance of attempting to keep the teeth by splinting. A decision may be altered strongly on the basis of the above considerations. For instance, we would be more likely to make an internal extracoronal splint if every one of a patient's remaining teeth required restoration; we would be more likely to do splinting for a 50 year old than for an 85 year old patient, both with an equal degree of breakdown.

USES AND BENEFITS OF TEMPORARY FIXED SPLINTING[16–21]

Since splinting cannot of itself cure periodontal disease, it must be considered as an adjunct to the other measures which are basic. To repeat, the primary value of temporary splinting is one of protracted tooth stabilization which enhances the potential of the periodontal tissues for repair. This period affords the opportunity of observing whether or not this repair occurs. Therefore, the final diagnosis and treatment plan may be more objective.

The correlary uses are numerous. It is easier to use instruments on these now stabilized, formerly loose teeth. A greater degree of access may be obtained by removing the splints prior to surgery. Pack retention is enhanced when the splint and surgical pack are placed simultaneously after the operation. Since firm teeth tend to heal better than do loose teeth post-surgical healing is improved.

Occlusal forces are distributed over a broader area so that less periodontal traumatism is likely. The use of multiple abutments affords increased support when missing teeth are restored. Retention is provided following minor tooth movement. Accidentally traumatized teeth and reimplanted teeth may be stabilized.

There are the mental and emotional values that relate to the improvement of the esthetic appearance of some dentitions. Moreover, the patient who has had his loose teeth made firm, has a greater feeling of security about his dentition.

FINAL DIAGNOSIS

If after the period of observation the teeth become firm and we have used an external device, then we may remove and discard the device. In some instances the patient may require some help from a removable device worn during the night, and in other instances no further support may be needed.

When an internal device has been used, we may be able to use the device as the final splint if it is cast metal and if no changes have occurred about the margins. In such a case the splint would be cemented to place. Otherwise we are committed to a reconstruction.

The transitional splint should be utilized to determine prognosis. Once a favorable prognosis is ascertained, there should be no hesitation in going on to the final prosthesis. Such a delay may only serve to magnify the secondary damage hazards outlined, and these damages may be as harmful as the loss of teeth with a questionable prognosis.

The observational splints may be useful as a temporary coverage during the period of final splint construction since they may be removed and replaced with ease, and they serve the patient as a functional dentition. The initial tooth preparations cause the formation of secondary dentin which may be of value in the final preparations. Furthermore, the experience of the initial construction becomes invaluable in the final construction, since we have by then encountered many of the dental, neuromuscular and mental pitfalls and treated them.

If the period of observation has led to the conclusion that the condition does not merit permanent splinting or that ultimately the teeth must be lost, the patient may still continue on with the temporary fixed splint as long as he can function in comfort. When a tooth is lost, it can be replaced with self curing acrylic. As the splint itself wears out, it can be replaced with another splint. Thus, the patient can make a gradual transition to the edentulous state. In many instances the loss of individual teeth is less traumatic to the patient since there is no change in the apparent dentition. In the same vein, because the transition to the edentulous state is gradual, and because the patient feels he has done everything possible to help himself, he may make a better adjustment to the loss of his teeth. Certainly there is bound to be less emotional impact than if the loss of the dentition were sudden and not expected.

CONCLUSION

Diagnostic, observational, and transitional splinting is an adjunctive measure in periodontal therapy in those cases where stabilization and a period of observation are indicated. This period of observation includes the maintenance of the splint which is a most important and difficult task. Therefore, these splinting techniques do not permit the substitution of inadequate technique, but demand skill, knowledge, and the practice of ideal operative dentistry.

The therapy includes the treatment of the whole dentition and the whole patient. One's powers of thinking, observation, and dexterity are exercised. Since the treatment relates to the improvement of borderline teeth and dentitions, the endeavor has heroic aspects, and is an extremely interest-

ing and fulfilling area of therapy. As Delabarre pointed out in 1819, "it is much easier to extract a tooth than to determine whether it (the extraction) is absolutely necessary.[37]

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Effects of Vitamin C on the Periodontium of the Syrian Hamster

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VARIOUS investigators have reported a variety of pathologic changes in the periodontal tissues of animals in vitamin C deficiency.[1-5] Since some of the findings in vitamin C deficiency have been shown to be comparable to those in periodontal disease, a relationship between such changes and periodontal disease has been suggested.[4,5] However, it cannot be inferred that vitamin C deficiency is a causative factor of periodontal disease, since it has been demonstrated that the administration of vitamin C to periodontal patients, even in massive doses, does not alleviate their condition.[6]

Only one experimental study is reported in the literature where the effects of dietary supplementation with vitamin C in animals susceptible to periodontal disease have been observed.[7] The authors did not find any significant differences between the periodontal lesions of the control and vitamin C fed rice rats. These findings were based on gross evaluation of the periodontal lesions, and no histologic observations were reported.

The present investigation was conducted to study the effects of dietary supplementation with ascorbic acid in hamsters susceptible to periodontal disease upon the periodontal tissues, and also to compare its effects with a new product, "high absorption vitamin C". The latter is a patented preparation[8] made by compressing small pellets of ascorbic acid, each coated with ethyl cellulose, into tablets. The tablets used in this investigation each contained 100 mg. of ascorbic acid. This preparation, which the inventor claims would be retained more effectively than conventional dosage forms, will hereafter be designated as HAC.

EXPERIMENTAL

Fifty Syrian hamsters, 35 days old, were divided into five groups comparable with regard to sex and weight. The basal diet used was Keyes ration #4[9] which consisted of whole wheat flour, 30; whole powdered milk, 30; confectioner's sugar, 15; corn starch, 20; alfalfa, 4; and finely powdered sodium chloride, 1. The animals of the first group were given basal diet while those of the second and third groups were maintained on basal diet plus 0.2% and 0.4% vitamin C respectively. The hamsters of groups 4 and 5 were given basal diet plus enough HAC to supply 0.2% and 0.4% of ascorbic acid respectively.

The animals were housed in individual wire-bottom cages and were given their diet and water ad libitum. After a 12 week feeding period, they were sacrificed. The periodontal lesions in the soft and calcified tissues were evaluated in terms of number and extent by the method of Gupta and Shaw.[10] Jaws from representative specimens were decalcified, sectioned and stained with hematoxylin and eosin.

RESULTS

All the animals gained weight uniformly during the experimental period. There were no grossly observable differences in fur texture among the five groups.

The periodontal lesions in the soft tissues were characterized by food impaction in the interproximal regions, recession and detachment of the gingival tissues from

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the surfaces of the teeth. Occasionally marginal gingivitis and small pockets filled with food debris were observed. Little or no calculus was noted. After the removal of soft tissues, areas of bone resorption were observed. The evaluation of the periodontal lesions in the soft and calcified tissues of the animals is given in Table 1. From the data presented, it can be seen that the animals maintained on basal diet plus vitamin C had slightly fewer and less extensive lesions in the soft and calcified tissues. However, the differences between the lesions of the control and vitamin C fed animals were not statistically significant. The same was true for the animals fed supplements of HAC.

These gross findings indicate that none of the vitamin C supplements reduced the incidence of periodontal lesions in the hamster significantly. Moreover, the effects of the two vitamin C preparations were not significantly different.

HISTOLOGIC FINDINGS

Since no significant differences in the histologic findings were observed between the specimens of animals receiving supplements of 0.2% and 0.4% vitamin C, the findings for the two levels are reported under one heading. The same was true for the animals receiving HAC, thus the findings with HAC at two levels are also reported under one heading.

Animals maintained on ration #4: (Controls) The representative specimens showed some degree of food impaction in the interproximal areas with desquamation of epithelium and a concomitant central depression of the transseptal fibers (Fig. 1). Slight infiltration of inflammatory cells in the lamina propria was observed. In most of the specimens, the epithelial attachment was at the cemento-enamel junction; in a few it had proliferated apically. The periodontal membrane fibers were loosely arranged. The alveolar bone showed areas of resorption (Fig. 2). Osteoblasts were flattened (Fig. 3). The marrow spaces were unusually widened, and there was fatty marrow formation (Fig. 4).

Animals maintained on ration #4 plus vitamin C: These specimens showed slight food impaction with less round cell infiltration in the subepithelial connective tis-

TABLE I

THE EFFECTS OF VITAMIN C UPON THE INCIDENCE OF PERIODONTAL LESIONS IN THE SYRIAN HAMSTER[1]

GROUP	Ration	Number of Rats	Number of Weeks	SOFT TISSUES: Number of Periodontal areas Av.	C.R.[2]	SOFT TISSUES: Extent of Periodontal lesions Av.	C.R.[2]	CALCIFIED TISSUES: Number of Periodontal areas Av.	C.R.[2]	CALCIFIED TISSUES: Extent of Periodontal lesions Av.	C.R.[2]
1	4	7	12	25.2 (3.1)	0.7	34.1 (4.1)	0.9	27.2 (0.9)	0.4	43.3 (7.1)	0.4
2	4+0.2% Vit.C	9	12	21.8 (4.1)	1.0	29.4 (3.9)	0.9	26.5 (1.5)	0.6	39.7 (5.7)	0.7
3	4+0.4% Vit.C	7	12	20.6 (3.2)	1.1	28.8 (4.0)	1.2	26.1 (1.6)	0.5	37.6 (4.6)	0.5
4	4+0.2% Vit.C (Added as HAC)	9	12	20.4 (3.0)	1.2	27.3 (4.1)	1.3	26.4 (1.4)	0.5	39.4 (4.5)	0.7
5	4+0.4% Vit.C (Added as HAC)	8	12	19.6 (3.6)		26.7 (3.9)		26.3 (1.7)		36.6 (5.9)	

1. The value within parentheses represents the standard error of the mean.

2. C.R. -- Critical ratio is the ratio of the difference between two means to the standard error of the difference between the means. Wherever the critical ratio is less than 2.0, the difference between the means is considered to be statistically insignificant; when the critical ratio is between 2.0 and 2.9, the difference is of borderline significance; when the ratio is 3.0 or higher, the difference is highly significant.

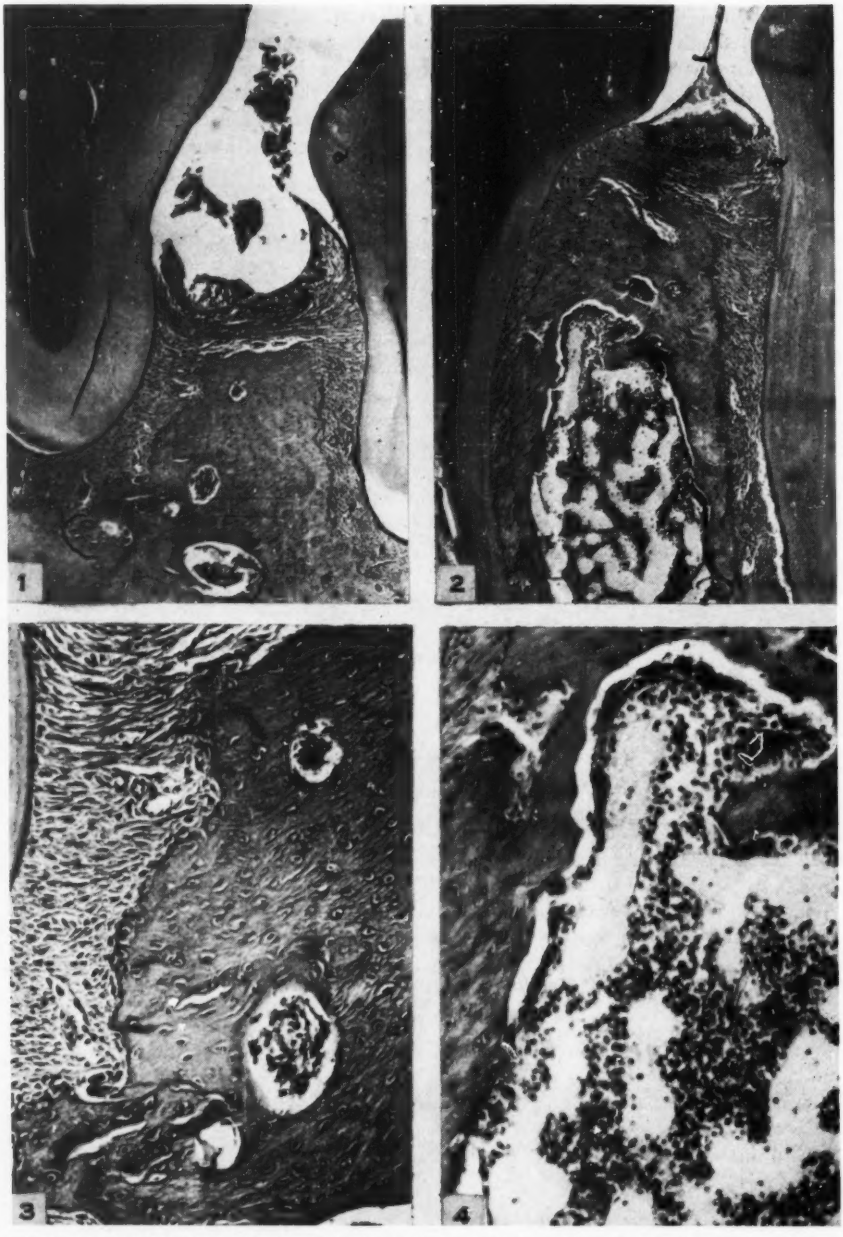

Fig. 1. Photomicrograph of interproximal area between the maxillary first and second molars in a control animal fed ration #4. Note the food impaction, desquamation of epithelium and central depression of the transseptal fibers. Hematoxylin eosin stain. Magn. X90.

sue than was seen in the control group. The epithelium was cornified and of normal thickness. The transseptal fibers were taut, straight and dense (Fig. 5). The periodontal membrane fibers were slightly more regularly arranged. The epithelial attachment was at the cemento-enamel junction. The bone marrow spaces were not as wide as those in the control animals. Osteoblasts were more numerous and more rounded than those of the control specimens (Fig. 6). The marrow was of the hemopoetic type (Fig. 7).

Animals maintained on ration #4 plus HAC: There were few or no food impaction areas with slight infiltration of inflammatory cells in the subepithelial connective tissue. The epithelium was normal in width and cornification. The epithelial attachment was at the cemento-enamel junction. The transseptal fibers were taut and thick (Fig. 8). The periodontal membrane fibers were slightly more regularly arranged than in the specimens of animals receiving supplements of vitamin C. The osteoblasts were greater in number than those of the vitaminn C animals. In addition, the osteoblasts were more rounded and slightly larger than in the vitamin C group (Fig. 9). In areas opposite to the formation of bone many osteoclasts were observed indicating great activity of bone tissue. The marrow spaces were still smaller than those of the vitamin C supplemented animals. The marrow was of the hemopoetic type (Fig. 10).

The histologic findings indicate that the animals receiving supplements of HAC had more regularly organized periodontal membrane and greater activity of bone remodelling than those receiving vitamin C supplements.

DISCUSSION

From the gross evaluation of the periodontal lesions, it is clear that addition of either vitamin C or HAC to the basal diet of the hamsters did not significantly alter the incidence of periodontal lesions. These findings are similar to those of Auskaps, Gupta and Shaw.[7] Furthermore, clinical studies[6] have not shown any effects of administration of high doses of vitamin C to humans with periodontal disease.

The histologic findings showed slight improvement in the periodontal membrane and alveolar bone of animals fed either

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Fig. 2. Photomicrograph of an interproximal area between the maxillary first and second molars in a control animal fed ration #4. Note the large marrow spaces within the alveolar process. Hematoxylin eosin stain. Magn. X90.

Fig. 3. Photomicrograph of an interproximal area between the maxillary first and second molars in a control animal fed ration #4. Note the flattened osteoblasts along the alveolar bone. Hematoxylin eosin stain. Magn. X150.

Fig. 4. Photomicrograph of higher magnification of Fig. 2 showing the formation of fatty marrow. Hematoxylin eosin stain. Magn. X150.

Fig. 5. Photomicrograph of an interproximal area between the maxillary first and second molars in a hamster fed ration #4 plus vitamin C. Note well cornified epithelium and regularly arranged transseptal fibers. Hematoxylin eosin stain. Magn. X90.

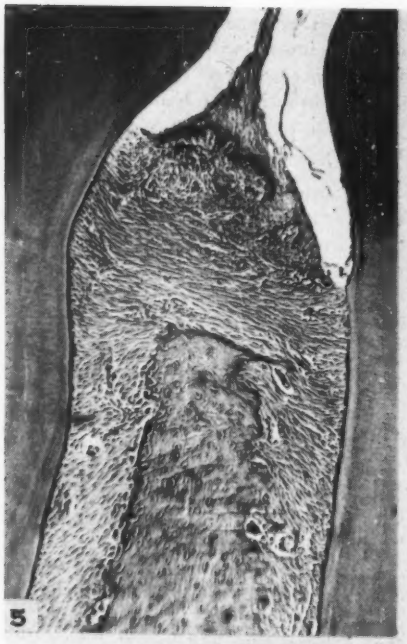
Fig. 6. Photomicrograph of a part of interproximal alveolar bone between the maxillary first and second molars in an animal fed ration #4 plus vitamin C. Note the more numerous and more rounded osteoblasts than in the control specimen. Hematoxylin eosin stain. Magn. X150.

Fig. 7. Photomicrograph of a part of bone marrow in interproximal area of an animal fed ration #4 plus vitamin C. Note the predominance of hemopoetic tissue as compared to that of a control specimen (Fig. 4). Hematoxylin eosin stain. Magn. X150.

Fig. 8. Photomicrograph of an interproximal area between maxillary first and second molars of a hamster fed ration #4 supplemented with HAC. Note well cornified epithelium; and dense, regularly arranged transseptal fibers. Hematoxylin eosin stain. Magn. X100.

Fig. 9. Photomicrograph of an area of alveolar bone between the maxillary first and second molars of a hamster fed ration #4 plus HAC. Note more numerous and larger osteoblasts than observed in control (Fig. 3) or vitamin C fed animals (Fig. 6). Hematoxylin eosin stain. Magn. X150.

Fig. 10. Photomicrograph of the marrow of the alveolar process in an animal fed ration #4 plus HAC. Note the hemopoetic nature of the marrow with relatively no fat marrow formation. Hematoxylin eosin stain. Magn. X150.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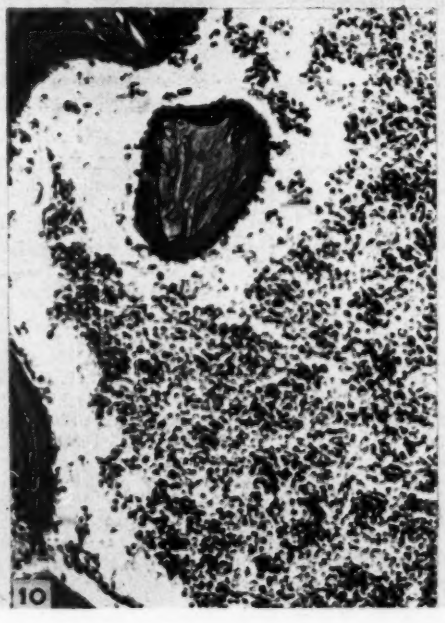
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type of vitamin C. The periodontium of those fed HAC was slightly better than those maintained on vitamin C. The larger and more numerous osteoblasts in the HAC-fed hamsters indicate their greater bone activity. This was also evidenced by the less wide marrow spaces in the HAC group. These findings suggest that HAC, in some unknown way, accelerates the process of mineralization of bone.

While the reason for the observed superiority of HAC in its effect on bone is not known, the differences between the histologic specimens in the vitamin C group on the one hand and the HAC group on the other were impressive.

SUMMARY

Fifty hamsters were used to study the effects of dietary supplements of vitamin C and of HAC on the incidence and extent of periodontal lesions.

The gross evaluation of periodontal lesions in the soft and calcified tissues did not show any significant differences between the lesions of the animals in the experimental groups and their controls.

The histologic findings indicated slight beneficial effects of both vitamin C and HAC on the periodontal tissues. The periodontal membrane fibers were more regularly organized, marrow spaces were less widened, and the osteoblasts were larger and more nearly spherical in animals fed supplements of HAC than those fed supplements of vitamin C.

ACKNOWLEDGMENT

We are indebted to Mr. H. Lowey of the Forest Laboratories, New York, N. Y. for a generous supply of high absorption Vitamin C.

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Vestibular Alterations in Periodontics

by MARVIN M. ROSENBERG,* D.D.S., *New York, New York*

MOST procedures for resolving periodontal conditions are marginal as are applied to the gingiva and bone. However, there are indications that make surgical intervention of the vestibule and muco-buccal fold an essential phase of periodontal therapy. Three of the more common conditions necessitating vestibular alterations are as follows:

1. Abnormal frenum or muscle attachment approximating the marginal gingiva. Frenum and muscle attachments usually end a distance from the gingival margin. Occasionally the attachment inserts directly on the free margin of the gingiva owing to either a developmental malpositioning, or periodontal disease and subsequent gingival recession. This high attachment commonly leads to difficulty in the proper placement of the toothbrush with consequent accumulation of food debris and calculary deposition at the cervical area. Distention of the mouth of the pocket occurs during the normal functional movements of the cheek and lip, thus minimizing the amount of shrinkage of the gingival margin following curettage.

2. Following a gingivectomy, or gingival recession, the gingival margin may be situated at or near the muco-gingival junction. This narrow band of attached gingiva presents several problems:
   a) Maintenance by the patient through oral hygienic technics and
   b) Restorative considerations where indicated.

3. Deep periodontal pockets ending at or apical to the muco-gingival junction in the alveolar mucosa.

SURGICAL PROCEDURES

Each of the above conditions necessitates a different surgical approach for its eradication. Study models, roentgenographs, scaling, curettage and occlusal adjustments, where indicated, should precede any vestibular alteration.

Abnormal Attachments: In the case of an abnormal frenum or muscle attachment a frenectomy usually suffices, depending upon the length of the alveolar process and the level of the muco-buccal fold. In regions such as the mandibular buccinator attachment in the premolar and molar areas, and, quite frequently, the mandibular labial frenum, the alveolar process is short and the muco-buccal fold is high. A frenectomy would result in the formation of a shallow vestibule. The procedure of choice in these cases is a combination frenectomy and vestibular extension, as follows:

1. Administration of anesthesia locally by infiltration. (The epinephrine content of the anesthetic agent aids in minimizing the bleeding from the wound).

2. Resection of the frenum by making a V-shaped incision. The apex of the incision is at the insertion of the frenum on the marginal gingiva and the diverging incisions border the frenum and are carried to approximately 3 mm. apical to the muco-gingival junction.

3. Carry the incisions laterally two or teeth on either side of the frenum.

4. Stripping of the buccal half of the muco-periosteum by sharp dissection ½ to 1 cm. apical to the muco-buccal fold. Bone is covered with periosteum.

5. Insertion of surgical cement.

Shallow Muco-buccal Fold: When, because of various circumstances, the muco-buccal fold becomes shallow and a vestibular extension is indicated, the surgical procedure is the same as that just described above in steps 3 and 4.

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Pockets Within Alveolar Mucosa: In the event that the deepest portion of a pocket is at or apical to the muco-gingival junction and within the alveolar mucosa, the desired result of surgical intervention is to increase the width of attached gingiva by placing the muco-gingival junction in a more apical position.

1. Administration of anesthesia locally by infiltration.

2. Marginal surgery, including gingivectomy, gingivoplasty and osseous contouring on the involved teeth terminating at the muco-gingival junction.

3. An incision is carried below the recontoured marginal gingiva to bone and extends approximately 3 mm. apical to the muco-gingival junction two or three teeth on either side of the involvement.

4. Reflection of the muco-periosteum by blunt dissection ½ to 1 cm. apical to the muco-buccal fold denuding the bone of periosteum.

5. Insertion of surgical cement.

Following this procedure the granulation tissue, during healing, differentiates into new zones of attached gingiva and alveolar mucosa. The periodontal ligament area acts as a contributing site of granulation tissue into the wound.

It has been observed that exposed alveolar bone will eventually be covered by attached gingiva.

SURGICAL PACK

The surgical cement must be carefully placed so that it is secure. Increased retention of the cement can be obtained by several methods such as insertion of the cement interproximally, wire ligation of teeth, and the use of tin foil or stents. The surgical cement is slightly irritating to the tissue but does not prevent healing nor cause any damage providing the pack is well placed and secure. An inert plastic

Fig. 1. Preoperative view. Note insertion of labial frenum, gingival recession, retention of food debris, materia alba, and gingival enlargement. A temporary splint of wire ligature and resin is present on the anterior teeth.

substance, telfa, may be placed on any exposed osseous tissue under the pack. This seems to enhance healing. The use of "orabase" as a vehicle for a topical anesthetic such as xylocaine ointment in equal parts offers a more comfortable post-operative course, when applied frequently to the vestibular fornix by the patient. The pack is removed after the first and second weeks post-operative for cleansing purposes and a new pack placed. After the third week the pack is removed and the patient is instructed in the use of finger massage until keratinization and healing is complete, at which time proper toothbrush technic is instituted.

HEALING PROCESS

Healing of the open wound is by secondary intention with bone, rather than

Fig. 2. Gingivectomy and gingivoplasty completed on the anterior teeth.

Fig. 3. Frenectomy and vestibular reduction completed to desired depth. Muscle attachments and connective tissue retracted by blunt dissection.

soft tissue, as the base. The area between the surgical cement and the alveolar bone is filled with inflammatory exudate and blood clot. This clot consists of interlacing shreds of fibrin together with erythrocytes and polymorphonuclear leukocytes. The clot acts as a scaffold upon which fibroblasts and vascular endothelium build granulation tissue. If the base of a wound is soft tissue the major source of fibroblasts and vascular endothelial buds is the base, but if the wound base is bone, these elements invade the blood clot from the soft tissue at the periphery of the wound and from the periodontal ligament at the crest. Epithelium begins to grow in over the granulation tissue from the periphery in four to five days as a delicate blue pellicle without rete pegs indicating its lack of age. Budding fibroblasts are seen beneath the epithelium. Further organization of the supporting connective tissue occurs and attachment of periodontal fibers can be seen at the crest of the alveolar bone. After the pack has been removed at approximately the twentieth day, healing progresses rapidly until a normal epithelium is reestablished. Massage and function will yield a firm, keratinized surface.

Fig. 4. Overextended surgical cement in place covered with tin foil. Note insertion of surgical cement into the incision.

ANATOMICAL CONSIDERATIONS

A thorough knowledge of the anatomy of the superficial and deep structures encountered during these surgical procedures is essential. The muscles of fascial expression one might come across are as follows:

1. *Incisivus labii superioris and inferioris.* These are small muscle bands which arise from the alveolar processes of the maxilla and mandible in the region of the lateral incisor teeth and are components of the orbicularis oris muscle.

2. *Quadratus labii inferioris.* This is a thin rhomboid muscle that arises below the canine and premolar teeth from the external oblique line of the mandible, between the mental protuberance and the mental foramen, and extends obliquely upward in a medial direction to the obicularis oris.

3. *Caninus.* This is a flat, quadrilateral muscle that arises from the canine fossa of the maxilla and runs beneath the quadratus labii superioris to the corner of the mouth. Between the caninus and the quadratus labii superioris there is a certain amount of fatty areolar tissue through which the infraorbital vessels and nerve run. The external maxillary artery crosses the lower part of the muscle.

4. *Triangularis.* This is a broad, flat subcutaneous muscle that arises from the external oblique line of the mandible below the canine, premolar, and first molar teeth. From here its fibers converge toward the corner of the mouth.

5. *Buccinator.* This muscle arises from (1) the molar portion of the alveolar process of the maxilla, (2) the buccinator crest of the mandible, and (3) the pterygomandibular raphe of the buccopharyngeal fascia. The fiber bundles of the muscle are divisible into four sets all of which insert into the orbicularis oris.

6. *Mentalis.* This is a short, thick muscle that arises from the alveolar process of the mandible over the area occupied by the roots of the incisor teeth and inserts into the skin of the chin.

7. *Nasalis.* The pars alaris portion of the nasalis muscle is a small quadrangular muscle situated between the aperture of the nose and the alveolar portion of the maxilla over the lateral incisor and canine teeth.

8. *Depressor septi nasi.* This muscle originates from the incisive fossa on the alveolar process of the maxilla in the midline and extends superiorly to

Fig. 5. Three weeks post-operative. Note granulating tissue and lack of primary union.

Fig. 6. Six months postoperative. Note new level of muco-buccal fold and zone of firm, keratinized attached gingiva.

insert on the nasal septum and posterior portion of the ala of the nose.

CASE REPORTS

Case 1.

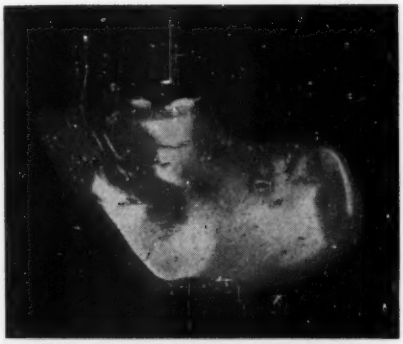
A 68 year old man was first seen in October 1957 in the Department of Periodontia and Oral Medicine, New York University College of Dentistry. An oral examination revealed the following: He was wearing a maxillary full denture, was missing the mandibular left third molar, and the right second molar which was replaced with a three unit fixed bridge. There was very poor gingival tone and notable gingival hyperplasia in the anterior region, moderate mobility of the teeth, pocket depth of 4 to 5 mm. in the anterior region, and 2 to 3 mm. in the posterior region, with mild exudate. Roentgenographic examination revealed areas of horizontal alveolar bone resorption. Recession of the labial gingiva had occurred on the right central incisor ending in the alveolar mucosa to a point below the attachment of the labial frenum. This area became a site of food impaction and calculary deposition due to very poor oral sanitation. It was noted that the attachment of the labial frenum exerted definite tension on the pocket wall of the right central incisor during lip movements (Fig. 1).

Periodontal therapy was instituted and consisted of scaling, instructions in oral physiotherapy, temporary stabilization of mobile teeth with wire ligature and resin in the anterior region, equilibration of the occlusion and curettage.

The gingival pockets were reduced by gingivectomy and gingivoplasty (Fig. 2). A V-shaped incision was made severing the frenum and was carried laterally beneath the muco-gingival junction from canine to canine (Fig. 3). The incision was directed toward the bone. Blunt dissection was used to free muscle and connective fibers and to reflect the muco-periosteum ½ to 1 cm. apical to the muco-buccal fold. After control of hemorrhage, surgical cement was placed into the incision, interproximally, and on the lingual and covered with tin foil (Fig. 4).

Postoperative instructions were given, and the patient was dismissed. One week later the surgical pack was removed and the operative site was irrigated. A new pack was applied and allowed to remain for another week. This procedure was repeated the following week. At the end of the third week considerable healing and epithelialization had occurred (Fig. 5). At this time finger massage of the tissue was instituted. Figure 6 illustrates the operative site after six months. There is a new zone of firm, keratinized, attached labial gingiva.

Fig. 7. (Upper left) Preoperative view. Note marked recession, high muco-buccal fold in molar region and retention of food debris.



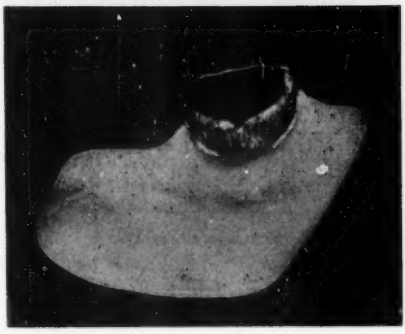


Fig. 8. Buccal and lingual view of acrylic resin stent. Note orthodontic band.

Case 2.

A 63 year old man was first seen in November 1957 in the Department of Periodontia and Oral Medicine, New York University College of Dentistry. An oral examination revealed the following: The patient was missing teeth in both arches, mobility was negligible, pockets 5 to 6 mm. in depth yielding an exudate on palpation was noted in most of the mandibular teeth and the maxillary canines. The gingiva was dark red, glossy and had undergone extreme recession. Roentgenographic examination revealed areas of horizontal bone resorption involving the posterior teeth.

Periodontal therapy was instituted and consisted of scaling, instructions in oral physiotherapy, equilibration of the occlusion, curettage, and localized gingivectomy and gingivoplasty procedures.

A pocket of 5 mm. extended into the buccal bifurcation of the mandibular right second molar. Because of the marked recession of the gingiva, the muco-buccal fold was shallow and the vestibular mucosa inserted into the pocket wall (Fig. 7). Horizontal food-impaction, inability to toothbrush properly for gingival stimulation, and tensional pull on the pocket wall during cheek movements were resulting factors. Loss of this tooth would necessitate a mandibular removable type appliance.

Fig. 9. (Upper left) Distal extent of incision.

After an appraisal of the alternatives, it was decided to attempt a vestibular extension in conjunction with pocket elimination and osseous contouring.

An acrylic resin stent was constructed utilizing an adapted orthodontic band. A wire strut was soldered to the buccal of the band to aid in the retention of the acrylic resin which was adapted to a study cast of the region (Fig. 8).

An incision was made from the external oblique ridge distal to the molar (Fig. 9) to the premolar area. Muscle and connective tissue fibers were detached by blunt dissection and the muco-periosteum reflected 1 cm. apical to the muco-buccal fold (Fig. 10).

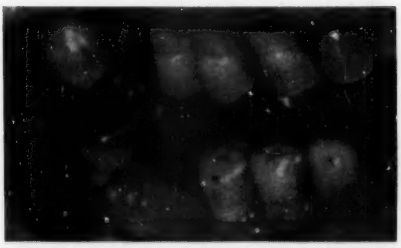


Fig. 10. (Lower left) Muscle and connective tissue fibers reflected.

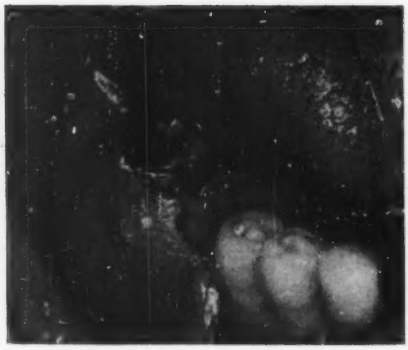


Fig. 11. (Upper right) Stent cemented in place over surgical pack.

Fig. 13. Six months postoperative. Note new level of muco-buccal fold, tissue tonus, and wide strip of firm, keratinized attached gingiva.

After the control of hemorrhage, surgical cement was placed into the incision and the overextended stent was cemented into place (Fig. 11).

The stent was kept in position for three weeks, with periodic changes of dressing, to insure adequate displacement of the buccinator muscle during healing. After this period of time (Fig. 12) finger massage was instituted until complete healing was achieved, at which point other oral physiotherapeutic agents were employed for optimum tissue stimulation.

Figure 13 illustrates the operative site after six months. The tissue integrity and tonus is greatly improved. The gingival complex has reoriented into a wider band of keratinized, firm attached gingiva. The muco-buccal fold is at a lower level allowing for tissue stimulation through proper oral physiotherapy. The buccal bifurcation is now self-cleansable and can be maintained.

Fig. 12. Three weeks postoperative. Note lack of primary union of wound.

CONCLUSION

Alterations of the vestibule and muco-buccal fold are valuable adjuncts in periodontal therapy. Appreciation and proper utilization of the various procedures discussed will contribute to more favorable and lasting results.

I gratefully acknowledge the help and guidance afforded me by Drs. Harry Roth and Sheldon Ross of the Department of Periodontia and Oral Medicine of New York University College of Dentistry.

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Announcements . . . .

AMERICAN ACADEMY OF ORAL PATHOLOGY

At a recent meeting of the American Academy of Oral Pathology held in Chicago, Illinois, the following officers for 1960-61 were elected: President, Captain R. Colby, DC, USN, Bethesda, Maryland; President-elect, Dr. David F. Mitchell, Indiana University School of Dentistry, Indianapolis, Indiana; Vice President, Dr. Carl Witkop, United States Public Health Service, Bethesda, Maryland; Secretary-Treasurer, Dr. Robert J. Gorlin, University of Minnesota School of Dentistry, Minneapolis, Minnesota. Dr. Mitchell was formerly head of Oral Pathology, School of Dentistry, University of Minnesota. Dr. Gorlin is the present Professor and Chairman of Oral Pathology, University of Minnesota.

THE ROWE SMITH MEMORIAL FOUNDATION

The 7th annual seminar of the Rowe Smith Memorial Foundation will be held December 2-5, 1960 in the Fly-n-Fish Lodge, Karnack, Texas. The subject will be "Stress" which will be discussed by Stewart Wolf, M.D. and James D. Hardy, Ph.D. Dr. Wolf is Professor and Head of the Department of Medicine, University of Oklahoma Medical School, as well as Chief of Psychosomatic and Neuromuscular Section of the Oklahoma Medical Research Foundation. Dr. Hardy is Director of Research at the Aviation Medical Acceleration Laboratory, U. S. Naval Air Development Center, Johnsville, Pennsylvania, and Professor of Physiology, School of Medicine, University of Pennsylvania. His work at AMAL is intimately associated with stress. The moderator will be Dr. E. Cheraskin, Head of the Department of Oral Medicine at the University of Alabama Dental School.

For further information write Rowe Smith Memorial Foundation, 501 State National Bank Building, Texarkana, Arkansas.

Correlation of Histologic and Clinical Findings in Periodontal Treatment

Effect of Scaling on Reduction of Gingival Inflammation Prior to Surgery

by MAJOR JAMES A. AMBROSE AND MAJOR ROBERT J. DETAMORE,
Lackland Air Force Base, Texas

THE purpose of this study is to attempt to determine on a clinical and histologic basis the value of pre-surgical scaling in promoting a more favorable operative field for surgical procedure with a shorter healing time. There has been much controversy not only in the field of periodontia but in general surgery as well concerning the value of preliminary clean-up procedures before definitive surgical interference.

REVIEW OF LITERATURE

Many references in the past have dealt with the benefits of clean-up procedures to reduce gingival inflammation prior to surgery.[1,2,3,4,5,6,7] Investigations carried out previously have been largely on a clinical basis. It is thought that this study will fill a void in the knowledge of periodontology and prove of clinical value to the practicing periodontist. Crile[1] says that the absence of foreign material is one of the chief factors that promotes sound and rapid healing of a wound. Christopher[2] states that the avoidance of wound complications begins with the patient's preoperative preparation. Goldman[6] indicates that incision into a gingival tissue which is almost completely cellular, with little fibrosis, clinically being soft, friable, and highly edematous results in poor healing. Tissue or granulation tabs may remain and the epithelialization of the wound sometimes is long delayed. Prior scaling of the teeth can be termed a conditioning of the gingival tissue in that wound healing takes place with resultant diminishing of the inflammatory process. Such a tissue, incised, tends to heal rapidly. Ramfjord[4,6] believes that scaling prior to gingival surgery is a rational, beneficial, safe, and practical procedure. Should sufficient reduction of gingival swelling occur, surgery would be unnecessary. It would violate the ancient code of medicine: "Nihil nocere. . . ." He states that gingivectomy is indicated and constitutes a rational procedure only for patients who document interest and ability in oral hygiene. This can be ascertained during pre-surgical scaling and home care instruction. Blanquie[5] advises that preliminary care should be given the tissues that are to be eliminated and that inflammatory changes within the periodontium should be reduced prior to pocket eradication. Orban[7] believes that the removal of irritating deposits encourages at least partial resolution of the inflammation, and that this reduces hemorrhagic tendency during surgical procedure and improves tissue response following it.

Thomas[6] writes, "It has been standard procedure for many, many years to avoid surgical interference in areas of acute inflammation, but this is not necessarily true where inflammation is one of a more chronic nature." He believes that the operator gains valuable information following scaling in gaining an idea of the ability of the tissues to recuperate. This indicates what can be expected following surgery and may suggest other pre-surgical procedures or prescriptions. Glickman[8] states that in the presence of acute inflammation, the eradication of periodontal pockets by any techniques should be postponed until the acute disease is resolved and symptoms subside. He believes that the purpose of the gingivectomy is to provide visibility and accessibility to make thorough removal of all irritants possible.[9] He sees no purpose

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in half-scaling a tooth and waiting for the gingiva to half-heal while permitting some of the very irritant responsible for gingival inflammation to remain on the root surface.[6] Shapiro[10] noted no differences in the rate of healing in his 700 patients scaled during the time of surgery. He postulates that surgical operation in an inflamed field may be desirable and result in greater success. He points to the observation that acute periodontal abscesses heal readily, and in many instances reattachment of the membrane and new bone growth occur.

Numerous valuable articles have been written concerning the findings in gingival biopsies.[11,12,13,14,15,16,17,18,19] These have not dealt specifically with the histologic results of clean-up procedures prior to and during surgery.

METHOD AND PROCEDURE

In twelve patients, male and female, ages 19 to 54 years, white and colored, each dental arch was divided into two quadrants, one designated as the pre-scaled quadrant; the other, designated as that scaled at time of surgery. Reasons for surgery were noted to be excessive soft tissue depth, unphysiologic contour of soft tissue, and insufficient attached gingiva.

In each quadrant scaled at time of surgery preoperative kodachrome films were taken. Then periodontal pockets were removed by surgical resection and root planing was carried out during the course of gingivectomy procedure. At the time of resection a biopsy was taken from the area including the disto-buccal of the second bicuspid, the interproximal and mesio-buccal of the first molar. Postoperative kodachrome films to record healing were taken at 1, 2, and 4-week intervals. A 4-week postoperative biopsy was taken from the same area biopsied previously (disto-buccal of the second bicuspid, the interproximal area and the mesio-buccal area of the first molar) to give histologic evidence of the extent of postoperative healing. It was thought a 4-week postoperative biopsy would serve as a desirable basis for an early evaluation of a patient's progress. All patients were directed to employ the modified Stillman's method of toothbrushing following removal of the surgical pack.

In the pre-scaled quadrants, preoperative kodachrome films were made for record purposes. Then a biopsy was taken in the same areas as in the quadrant where root planing was carried out at the time of surgery. At this same sitting root planing procedures were accomplished until no roughness of root surfaces could be felt.

In approximately 18-21 days all residual pocket depth was eliminated by surgical resection. At the time of the resection the bicuspid-molar area originally biopsied was re-biopsied. A kodachrome film was made for record purposes prior to the resection. Postoperative kodachrome films were taken at intervals of 1, 2 and 4 weeks. A 4-week postoperative biopsy was taken from the same area biopsied previously to determine the extent of healing histologically. Areas biopsied varied from early periodontitis to advanced periodontitis. A total of 115 gingival biopsies were taken in this experiment.

A histological diagnosis of minimal inflammation indicated a low degree of leukocytic infiltration near the base of the gingival sulcus as a response to bacterial metabolites which in some degree are always present in the normal gingival sulcus.

RESULTS ON QUADRANTS SCALED AT TIME OF SURGERY

Thirteen sections included chronic or diffuse chronic inflammation upon original biopsy. Following surgery these cases revealed minimal healing period.

One interdental papillary area was initially biopsied and diagnosed as chronic inflammation. Thirty days following surgery the same area histologically revealed focal ulceration, and acute inflammation. This patient exercised very poor oral hygiene following removal of the surgical pack.

Eight initial biopsies were diagnosed histologically as minimal inflammation. Four weeks later, following surgery including scaling at time of surgery, biopsies from the same interdental papillary areas revealed again minimal inflammation consistent with normal healing.

RESULTS OF PRE-SCALED QUADRANTS

One biopsy section initially revealed acute inflammation. Eighteen days after scaling a re-biopsy of this same interdental papillary area indicated minimal inflammation. Thirty days later the specimen from this same area again presented minimal signs of inflammation.

Eight cases which demonstrated histologically chronic or diffuse chronic inflammation were scaled and root planed. After 18-21 days, the areas were re-biopsied and

Biopsies from Pre-Scaled Quadrants

No. Quadrants	*Initial Biopsy*	*18-21 Days*	*4 Weeks*
1	Acute Inflammation	Minimal Inflammation	Minimal Inflammation Indicating a Favorable Repair Response
8	Chronic, or Diffuse Chronic Inflammation	Minimal Inflammation	Minimal Inflammation Consistent with Healing
12	Minimal Inflammation	Minimal Inflammation	Minimal Inflammation Compatible with Early Healing Gingiva
1	Lost	Minimal	Diffuse Chronic Inflammation

diagnosed as minimal inflammation consistent with healing.

Twelve cases were intially diagnosed as minimal inflammation. Eighteen to twenty-one days following scaling and root planing these same areas were re-biopsied to reveal minimal inflammation. The final biopsy 4 weeks following surgery again indicated minimal inflammation compatible with early healing gingiva.

One initial biopsy specimen was inadvertently lost during the period of processing at the histo-pathology laboratory. Eighteen days later following scaling a re-biopsy of the same interdental papillary area revealed a minimal inflammatory infiltrate. Four weeks later upon histological examination the tissue from the same area demonstrated a diffuse inflammatory infiltrate of plasma cells and lymphocytes. The epithelium was continuous but was not reorganized in the usual gingival form. The patient's cooperation in oral hygiene procedures was poor.

DISCUSSION

As expected the 18-21 day histological tissue specimens were not as mature as the 4-week specimens. However, even the 4-week specimens in practically all cases did not present mature reorganization or re-constitution of the gingiva in the usual form. Additional time is necessary for full maturation. Often epithelial hyperplasia with thickening and acanthosis was evidenced. Marked vascularity indicated a healing process. The overlying epithelium many times showed continuity but not the usual architecture of normal gingiva. At 4 weeks one did not observe the downgrowth of the rete ridges which are found in normal matured gingiva. These were often blunt with a thin epithelial covering which demonstrated tissue in the process of healing. Only early collagen formation was present. Myxomatous degeneration was seen in both young and well-matured gingiva.

Additional interesting findings in the biopsies were the numerous epithelial rests

Biopsies from Quadrants Scaled at Time of Surgery

No. Quadrants	*Initial Biopsy*	*End of 4 Weeks*
13	Chronic, or Diffuse Chronic Inflammation	Minimal Inflammation Consistent with Healing
1	Chronic Inflammation	Acute Inflammation Focal Ulceration
8	Minimal Inflammation	Minimal Inflammation Not Fully Reconstituted

of Malassez, migrating cemental fragments, gingival cysts and eosinophils. Hyalinized connective tissue was seldom observed in the 4-week sections. It was frequently observed in the matured preoperative sections.

Two untoward results were evidenced. In each instance the oral hygiene of both patients was poor as considerable materia alba was observed.

It is felt that a more informative method of investigation would be to have serial sections of tissues prepared. Unfortunately this was not feasible due to limitations of personnel and facilities.

SUMMARY

A total of 12 patients, both male and female, white and negro, ranging in age from 19 to 54 years were treated for periodontal disease by surgical resection with root planing procedures accomplished either prior to or during the surgical procedure. Gingival biopsies were employed to determine the histologic status of the tissues prior to any debridement, at the time of the surgical intervention, and 4 weeks postoperatively. Serial kodachromes of the test areas were taken to determine the rate of clinical healing following operative interference. Many variables enter into a clinical study of this type. These include the patient's resistance and healing ability, the degree of patient oral hygiene cooperation, and the physical consistency of the diet.

CONCLUSIONS

This study did not conclusively prove the value of pre-surgical root planing in promoting a more favorable operative field for surgical procedures within a shorter healing time. The greater number of quadrants treated in this study showed histologically a chronic or minimal degree of inflammation at the beginning. Therefore, no great amount of healing could be anticipated following root planing procedures. In all cases histologically there was either a reduction in inflammation or no increase following the root planing procedure. Certain other advantages cited for preliminary clean-up procedures may make it desirable for the operator to perform initial root planing prior to surgery. The preoperative debridement as stated by many clinicians is of very definite value in determining the patient's interest and ability in home care procedures. The healing potential of the patient can also be assessed by these operations.

From the clinical standpoint it was impossible to determine the exact histologic state of the tissues. In many cases where clinically one might observe an apparent acute inflammation the biopsy would reveal inflammation of a chronic nature. Occasionally where clinically there was an apparent chronic inflammation the biopsy would reveal minimal inflammation and vice versa.

The authors wish to express their appreciation to the Department of Oral Pathology—3700th USAF Hospital, Lackland AFB, Texas, for their invaluable assistance in the interpretation and preparation of the histologic material used in this study.

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The Effects of a Closely Supervised Oral Hygiene Program Upon Oral Cleanliness

by ROBERT J. ADAMS, D.D.S.* AND WILLIAM R. STANMEYER, D.D.S.†

WHAT are the effects of a closely supervised oral hygiene program upon oral cleanliness? Dental education of the patient in proper toothbrushing techniques must emphasize the importance of mouth cleanliness for oral and general health. While dental education is the responsibility of the dentist, unfortunately the relationship between the patient and the dentist is usually restricted to periodical appointments and to specified time limitations. The cost of very thorough routine instructions in oral hygiene is prohibitive under the present dental office management.

Furthermore, the dentist is not able to observe the day-by-day oral hygiene practices of his patients. In isolated periodontal disorders, time is spent on the proper use of the toothbrush after the damage has already permanently afflicted the supportive tissues. The promotion of proper oral hygiene can only be accomplished by proper instructions coupled with patient cooperation and the observed effectiveness with patient interpretation of the instructions. This should be established before irreparable damage has befallen the hard and soft dental structures. In this study, an evaluation of the effects of a closely supervised oral hygiene program upon oral cleanliness has been made.

A unique opportunity to evaluate the effectiveness of almost day-by-day dentist-patient relationship came when a dentist was included in the group of scientific and support personnel scheduled to "winter-over" in the Antarctic. This expeditionary force of 109 men were to be completely isolated for a year at Little America V in connection with the 1957-58 International Geophysical Year Program.

Past expeditions to the Antarctic have routinely reported poor oral hygiene practice with lack of oral cleanliness. Frazier,[1] a physician with the late Admiral Byrd at Little America III during the 1939-41 expedition reported: "All of our problems

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medically, were connected with teeth." On all previous expeditions, dental treatment for the never-ending, ever-plaguing dental emergencies demanded the primary attention of medical personnel. Gaevier[2] states that the use of the toothbrush during these expeditions occurred only on ceremonial occasions. The opportunity in Antarctica to measure the effectiveness of a closely supervised oral hygiene program was unprecedented considering (1) the challenge of the deplorable state of oral cleanliness reported upon previous expeditions and (2) the everyday close community relationship of the dentist and his patient.

METHOD

The experimental group consisted of 103 men with a mean age of 28.3 and a range from 18 to 56 years. All examinations and dental education were performed by one dentist who accompanied and lived with this group both in the United States and Antarctica for a total of eighteen months. At no time did the examiner have access to his previous records of the patient until the conclusion of the experiment insuring against predilection.

Prior to leaving for the Antarctic, each man was given a thorough clinical examination at which time an estimation of his oral cleanliness was made, using a *Good—Fair—Poor* criteria. To be graded *"Good"* the examiner was unable to remove debris from any tooth using a No. 7 dental explorer. A *"Fair"* classification meant that debris could be removed from a posterior tooth, and a *"Poor"* classification indicated that debris was removed from an anterior tooth as well as a posterior tooth. At this time, each man was also asked to fill out a Health Diary which contained, among others, questions on the number of times a day he brushed his teeth and when during the day he performed this function.

Following the first dental examination the supervised oral hygiene program was initiated by the presentation of a new toothbrush* to all personnel scheduled for departure to "winter-over" at Little America, Antarctica. This phase of the program was supplemented with group oral hygiene instructions through lectures and films on the proper care of the hard and soft dental tissues.

The second phase of the program was put into effect upon arrival of the experimental group at Little America. At this time, and each month thereafter, each man was given a careful clinical examination; the cleanliness of his oral structures was reassessed. He was asked to again complete the Health Diary. During these visits, and in the time intervening between visits, efforts were made to improve individual oral hygiene by (1) model demonstrations (2) dentist observation of patient toothbrushing technique (patient's oral demonstration) and (3) stimulation of patient's pride and interest by means of the personal concern manifested by the dentist.

A control group of 36 men was also established. This group had an initial examination and assessment of oral cleanliness, but received none of the group or individual instructions. This group was not seen monthly and their oral hygiene was reassessed only once again at the termination of the experiment.

RESULTS

The effects of a closely supervised oral hygiene program upon oral cleanliness are correlated in Figure I.

At the initial examination 56 percent of the population were found to be *"Fair"* prior to any oral hygiene instruction. Fortunately, the category labeled as *"Poor"* contained the smallest number, 15 percent of the total. Unfortunately, the category labeled *"Good"* was also in the minority containing 29 percent. No significant change was demonstrated between the pre-Antarctic oral hygiene and the first assessment upon arrival in the Antarctic.

With repeated detailed individual instructions, the *"Good"* evaluations in-

*Compliments Oral B Co.

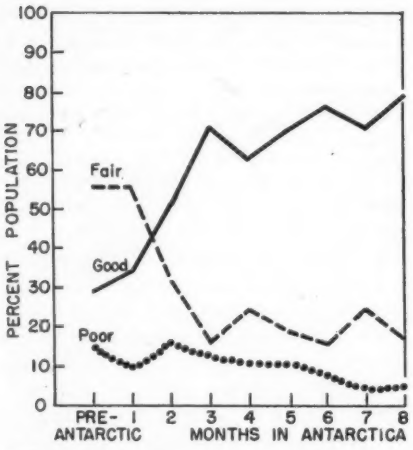

Fig. I. Monthly assessment of oral cleanliness by percent of population as **good—fair—poor**, following an intense and repeated oral hygiene educational program.

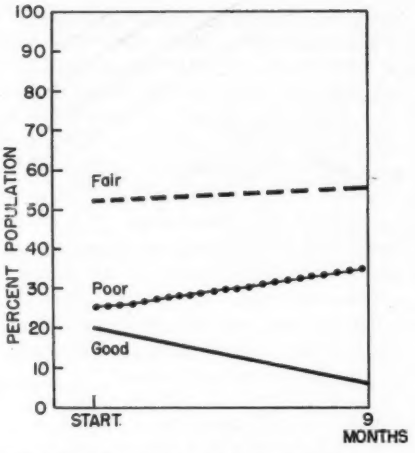

Fig. II. Assessment of oral cleanliness by percent of population seen initially and after nine months without benefit of oral hygiene educational program.

creased progressively and were maintained at extremely high percentage levels. The *"Fair"* and *"Poor"* evaluations were inversely proportional to the high *"Good"* percentages until after eight months of concentrated education when the group distribution changed to 79 percent *"Good,"* 18 percent *"Fair"* and 5 percent *"Poor."* During the year over 600 toothbrushes were sold to camp personnel bringing about an average of a new toothbrush every two months per man. An assessment of pre-Antarctic toothbrushing habits indicated that the 103 men brushed a total of 192 times a day of which 126 or 66 percent were considered effective (brushing after eating). A reassessment upon the termination of the experiment indicated that the total number of brushings of 102 men per day had increased to 238 and the number of effective brushings to 164 or 69 percent.

The results of the lack of an oral hygiene program for the control group upon oral cleanliness are shown in Figure II.

In this group it appears that the percentage of *"Fair"* evaluations remains virtually unchanged. The *"Poor"* classification shows an increase in percentage whereas the number of men able to maintain a *"Good"* level declines.

An assessment of toothbrushing habits of this group shows that, initially the 36 men brushed a total of 73 times a day, 46 or 63 percent of these brushings being counted as effective. Nine months later this group had total brushings of 66 times per day or 63.6 percent effective brushings.

DISCUSSION AND CONCLUSIONS

A closely supervised oral hygiene program resulted in a dramatic increase in tooth cleanliness and an increase in both total and effective brushings. These improvements did not occur in the control group.

The initial estimation of the oral hygiene made on the control group showed 20 percent *"Good,"* 52 percent *"Fair"* and 25 percent *"Poor."* The initial estimation of the oral hygiene made on the experimental group showed 29 percent *"Good,"* 56 percent *"Fair,"* and 15 percent *"Poor."* (Figure I and II). These percentages were within significant statistical limits when compared with a much larger group[3] which showed 22 percent *"Good,"* 56 per-

cent "*Fair*" and 20 percent "*Poor.*" Figure II illustrates that no improvement occurs without a concentrated effort on the part of the dentist. Figure I has shown that even after group instruction while still in the United States, the first examination in Antarctica remained substantially the same as the pre-Antarctic evaluation. This is because of the fact that while the men were in transit, personal contact was limited and continuing personal instructions and education was not possible.

When the group was finally assembled and personal contact occurred between dentist and patient on a day-to-day basis, oral hygiene began to improve. After three months of training and living in close proximity to the men, 70 percent were judged to maintain good oral hygiene. Men began to take pride in the conditions of their mouths and formed a "Gum Count Club"[4] in which they compared the state of their oral health. No such enthusiasm was generated in the control group. The dentist's efforts were rewarded at the Command Level by the building of adequate spaces for toothbrushing in response to a demand by camp personnel. The camp had operated during the previous year without a dentist, without a supervised program of oral hygiene, and without space and facilities for toothbrushing.

It is evident that preventive dentistry begins with dental education. Dental education of the patient begins with the proper use of the toothbrush. A constant program of dental prevention will convert the ever arising dental emergency to the problems of routine dentistry, since oral health is directly proportional to proper oral hygiene.

SUMMARY

The effects of a closely supervised oral hygiene program in Antarctica are reported. The dentist lived for over a year at Little America V, Antarctica in day-to-day contact with his experimental group. Results showed that a remarkable state of oral cleanliness could be obtained by emphasis of the proper toothbrushing techniques as well as emphasis on the importance of oral hygiene. This condition was brought about by an increase in both total and effective (after-eating) toothbrushing. These results did not occur following group lectures and movies, but came only after concentrated *personal* contact and *personal* effort on the part of the dentist and the formation of close association between dentist and patient.

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Unusual Deposition of Calculus

by BERNARD S. MOSKOW, D.D.S.,* *Boston, Massachusetts*

SUPRAGINGIVAL deposits of dental calculus occur most frequently, and in the greatest quantity, on the buccal surfaces of the maxillary molar teeth and on the lingual surfaces of the mandibular anterior teeth. This has been explained on the basis of the proximity of these tooth surfaces to the orifices of the major salivary glands. The upper molars lie adjacent to Stensen's duct, whereas the incisors approximate the openings of both the submaxillary and sublingual glands. The following is a case in which abnormally heavy salivary concretions deposited in a posterior area of the mouth, satisfied the need for an increase in functional tooth surface area.

CASE HISTORY

On December 21, 1959 a twenty-seven year old negro female appeared in the hospital dental clinic for routine dental examination and care. She had no pain or discomfort at the time of examination, and was not aware of the presence of anything abnormal in her mouth.

Past Dental History: Previous to this visit, the patient had not received dental care since 1955. At that time she was treated by her private dentist, who because of the problem of advanced caries, advised full mouth extraction. He had initiated this plan of therapy by extracting two teeth at a time for a period of several visits. The entire treatment plan, however, was not carried through to completion because the birth of her first child was imminent. Subsequently, the patient has given birth to two additional children. Prior to her visits to the dentist in 1955, the patient had apparently been quite negligent in the care of her mouth, having not had any dental treatment since attending grammar school.

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Fig. 1. A twenty-seven-year-old negro female demonstrating heavy supragingival deposits on the mandibular anterior teeth and the maxillary left posterior region.

Medical History: Aside from the common childhood infectious diseases, the patient has enjoyed good health during her entire life, even during the periods of her pregnancies. She has had periodic medical examinations, and was last seen by a hospital physician on October 4, 1959, at which time she was reported in excellent condition. Her family medical history is unrelated.

Oral Findings: Examination revealed the presence of a partial dentition consisting of $\frac{31 \mid 1237}{4321 \mid 1237}$. Many of these teeth contained extensive carious lesions, some envolving the pulp of the tooth. Excessive drifting, with loss of interproximal contact, was evident in every area. The gingival tissues, particularly in the mandibular anterior re-

Fig. 2. Large masses of calculus encasing maxillary and mandibular left second molars.

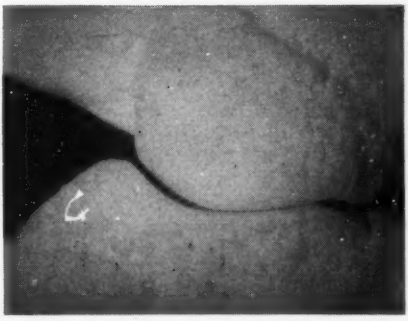

Fig. 3. Buccal view of occluding "biteblocks" of dental calculus.

gion, were acutely inflamed, edematous, and markedly hyperplastic. The patient's oral hygiene was extremely poor and deposits, both supragingival and subgingival were excessive (Fig. 1). Other oral tissues, including the lips, buccal mucosa, floor of the mouth, and palate, were normal in every respect. Radiographic examination revealed numerous carious lesions, however, evidence of periapical infection was absent. What appeared to be a residual root fragment was seen located superficially in the alveolar bone in the region of the lower left first molar.

CALCULUS

The unusual aspect of this case was the bizarre distribution of the calcareous deposits. Although the maxillary anterior teeth were relatively free of supragingival calculus, the lower anterior teeth were heavily coated, including a great portion of the labial surfaces, an area which is usually relatively free from deposits Posteriorly, the situation in respect to calculus formation was quite unique. Both the maxillary and mandibular left second molars were completely covered by calculus on all surfaces (Fig. 2). On the buccal, the deposits extended into the region of the mucobuccal fold, encasing not only the clinical crowns

Fig. 4. Maxillary and mandibular left second molars following extraction. A portion of the deposits on the buccal surface was accidentally removed. Observe the pebble-like appearance of the concretions.

Fig. 5. Wear patterns on occlusal aspect of calcular mass.

Fig. 6. Bitewing x-ray showing masses of calculus in occlusion.

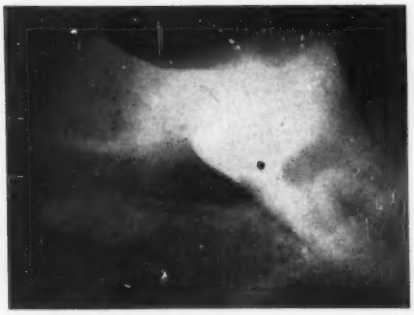

Fig. 7. X-ray of lower left second molar; observe the cantilever effect of the bridge of calculus.

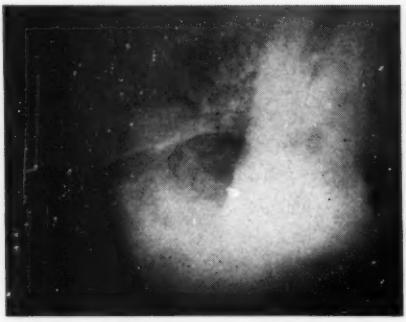

Fig. 8. X-ray of upper left second molar. Note the radiolucent area in the alveolar bone adjacent to the calcular mass.

of the teeth, but covering the attached gingiva and alveolar mucosa in the area. On the palatal and lingual aspects, the calcular mass extended onto the palate in the upper and approached the floor of the mouth in the mandibular arch. Bridges of calculus extended mesially from the teeth, filling the edentulous area formerly occupied by the first molar and giving the appearance of a cantilever bridge. Distally, the concretions reached to the area of the retromolar pad on the lower arch and to the hammular notch region in the maxillary arch. Of interest, was the manner in which the calculus completely covered the occlusal surfaces of the teeth, forming two complete blocks of calcified material and resembling the "bite blocks" commonly used in obtaining jaw relationships when constructing dentures. The maxillary calcareous mass simulated the curvature of the arch and appeared convex from the buccal aspect. The mandibular mass, being concave, fitted directly together with its antagonist (Fig. 3). Wear patterns, or facets, worn into the occlusal surface of the concretions indicated that the patient was apparently utilizing these artificial chewing surfaces in the various jaw movements. The deposits were light brown in color and presented a pebble-like texture on the facial, lingual, and proximal aspects (Fig. 4). The occlusal surfaces were extremely smooth giving the appearance of polished stone (Fig. 5).

On x-ray, the deposits appeared in various degrees of radiopacities indicating differences in calcification in any particular area of the mass. On the mesial aspect of both the maxillary and mandibular molars the calculus was seen lying directly adjacent to the edentulous alveolar ridge with some degree of resorption taking place in the bone (Figs. 6, 7, 8).

DISCUSSION

Since the maxillary and mandibular left second molars were the only posterior teeth remaining in the dentition that were in occlusion, the patient continued to efficiently utilize this area without being cognizant of the excessive deposits of calculus that had accumulated. The deposits adhered in such a manner so as to provide an enlarged occlusal table, thereby acting as additional teeth and increasing the potential area for function.

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Abstract . . . .

Study of Periodontal Disease and Occlusal Trauma by Use of the Index of the Alveolar Resorption

by Dr. Bozidak Kuljaca, *Beograd, Yugoslavia*

There is a need for a definite method for recording the severity of periodontal disease *in vivo* in a manner acceptable to the epidemiologists. Dr. Kuljaca studied many of the proposed plans (tooth mobility measurements, the PMA index, X-ray index, and others), and he finally developed the "index of alveolar resorption" (IAR). This he calculated by determining the average resorption of the alveolar septum for each tooth (using radiographs) and dividing this by the length of the tooth. For example, if there is no alveolar resorption and the length of the root is 18 mm., then IAR equals 0 ($\frac{0}{18} = 0$). If mesial resorption amounts to 3½ mm., distal resorption to 1½ mm., and the root length is 18 mm., then the IAR equals 0.138 $((3\frac{1}{2} + 1\frac{1}{2} \div 2) \div 18) = 0.138$). If resorption on a tooth with a 18 mm. root length is 18 mm. then the IAR equals 1. Kuljaca reports that the values of IAR are usually found to be between 0.05 and 0.03 in patients from 18 to 58 years of age.

Kuljaca has applied "IAR" to more than 100 patients and reports that it represents an easy method of establishing and reporting the severity of pathologic processes involved as shown by radiographs. He also uses IAR as a gauge in determining the results of therapy.

The IAR deserves further testing since it may have a valuable role in assessing the severity of periodontal disease and evaluating the results of therapy.

For further details regarding "IAR" please write the author, Dr. Bozidar Kuljaca, Dobrinjska 5/1, Beograd, Yugoslavia. *M. K. H.*

BOSTON UNIVERSITY

The Department of Stomatology, Division of Graduate Studies, School of Medicine, Boston University, and the Massachusetts Memorial Hospitals, announces the following postgraduate course:

Occlusal Adjustment, by Drs. Bernard S. Chaikin, Henry M. Goldman, Gerald M. Kramer, William Pendergast, Jack Bloom and Associates.

The course will be presented September 12 to 16, 1960 and the fee will be $200. For further information write Director, Postgraduate Courses, Department of Stomatology, Massachusetts Memorial Hospitals, 750 Harrison Avenue, Boston 18, Massachusetts.

Editorials . . . .

COMMENTS FOR RECENT GRADUATES

There was a cartoon published recently which showed two parents reading the diploma just received by their son who was still in the traditional cap and gown. The caption was: "His diploma merely states that he graduates; shouldn't there be further instructions?" Sorry, ladies and gentlemen of the 1960 dental graduating classes, but no further instructions go with your diplomas—congratulations, good wishes and our prayers, but no instructions. However, following are a few comments we wish to offer each of you.

The diploma you received merely indicates that you have completed a course of study in dentistry offered in the years 1956 to 1960. In three, five or ten years from now much of what you have learned will be out-dated and some of it actually wrong. Therefore you must develop a system for your "continuation education" if your patients are to receive the best of treatment and your practice remain modern. This continuation education program should include systematic reading of a series of current professional periodicals, regular attendance at dental society meetings (not merely class reunions), periodic enrollment in refresher courses, study clubs, etc. Someone facetiously suggested that all diplomas be printed on paper which would disintegrate in ten years, making it necessary for those who desire to have one to return to college to earn another. This idea has never gained any popularity, for some reason, but it does have some virtue.

Your diploma does not state that you have learned all that is to be known about dentistry or that you have developed your skills to the utmost, but merely that you have been judged competent to proceed without close supervision, and if a state board of examiners agrees, to begin a private practice. Shortly after you do open your office you will undoubtedly be visited by a patient with a problem which you cannot readily solve. Some of you will study this problem, seek consultation, and finally find a solution. Those of you who do this will continue to develop year by year, and eventually can become leaders in your profession. Others will dodge the problem and perhaps simplify it by extractions. Those of you who do this will find your knowledge and skill will gradually wither. Which group will you join? It depends upon you.

Your diploma does indicate that you are a member of a select group which has been given the privilege of using the degree, "Doctor of Dental Surgery." This degree, plus your license from a state board of dental examiners, gives you special privileges guaranteed by the state in which you practice. With these privileges go many obligations—including that of building a practice which is modern, busy, lucrative (but not with exorbitant fees) and ethical, of advancing the dental profession and the community, and of assuming the role of a responsible professional gentleman. We urge that each of you respect your privileges and assume the responsibilities that go with them.

No better examples of "continuous students" could be found than two of our respected and revered colleagues, Doctors Balint J. Orban and Joseph P. Weinmann, who both died recently. These outstanding professional gentlemen not only continued to study throughout their lives—they also assisted and stimulated others to do so. Orban and Weinmann will be sorely missed. We here present brief summaries of their careers which were prepared by their good friend and contemporary, Dr. Harry Sicher.

Balint J. Orban

1899-1960

Balint Orban died on June first, 1960, after almost forty years of intensive and greatly admired work as a clinician, researcher and teacher.

Born March 24, 1899, in Temesvar, Hungary, he got his medical degree from the University in Budapest in October of 1922. In 1923 he came to Vienna to join the Department of Histology and Histopathology of the Dental Division of the Vienna Medical School under B. Gottlieb. For his outstanding scientific achievements he was awarded the medical degree of the Vienna University in 1930. After visiting the United States in 1926 on the occasion of the International Dental Congress in Philadelphia, he was invited by Dean W. H. G. Logan to join the Chicago College of Dental Surgery, Loyola's Dental School, and to organize its "Foundation for Dental Research." From 1927 to 1929 he worked at this school as Assistant Professor of Dental Pathology. For almost ten years he then worked and taught at the Vienna University where he was appointed an Associate Professor of Dentistry. Under the pressure of political changes he returned to Chicago in the last days of 1937 and taught at the Northwestern University's Dental School as Associate Professor of Oral Pathology until 1940. In the fall of 1938 he received the degree of Doctor of Dental Surgery from Northwestern University. After Rudolf Kronfeld's death in 1940, he returned to the School of Dentistry at Loyola University as Professor of Oral Pathology. There follow two years, 1947 to 1949, as a Research fellow at the Dental College of the University of Illinois. Practicing and teaching in Colorado Springs, he kept his ties with Chicago and held from 1952 to his death the position of a Professor of Periodontics at Loyola University.

He was a member of many Dental Societies, the International Association for Dental Research, the Fédération Dentaire Internationale, the American Academy of Oral Pathology, Academy of Periodontology, etc. Among many honors he received the much coveted Miller Prize in 1952.

Orban's scientific work was concerned with problems of Histology and Pathology. At a time when dentistry made great strides in building a solid foundation of basic knowledge for its clinical endeavors, Gottlieb's laboratory was a center of almost feverish activity. Orban's papers on the histology of the enamel, especially lamellae and tufts, were published, preceded by a classic paper on early tooth development. Dentinogenesis was clarified and also the behavior of the periodontal ligament during the period of fast eruptive movements. Investigations of the cellular components of the pulp revealed the presence of a host of defense elements. Resorption and repair of cementum were carefully studied. Since the understanding of periodontal disease was one of the main goals of Gottlieb and his group, the preoccupation of Orban's with the normal appearance, structure and classification of types of the oral mucosa is an ever returning theme. After the discovery of an epithelial attachment by Gottlieb had been challenged, Orban and his co-workers proved conclusively that this challenge had rested on erroneous interpretations. With Wentz and Maier, age changes and sexual differences in the structure of the gingiva were studied, and with Weinmann the histopathology of periodontosis. A great number of excellent publications followed: gingivitis in pregnancy was investigated by Orban and Maier, as well as gingival changes in diabetes.

Since the early classic experiments on occlusal trauma, conducted by Gottlieb and Orban, this problem never ceased to interest Orban. He and Weinmann could show

changes in human jaws that duplicated the changes seen in experimental animals. With Bhaskar the influence of jiggling movements on the supporting structures was studied.

All the experience—clinical, histologic, and experimental—led Orban to a scientific classification of periodontal diseases and finally to a summation in a text on "Periodontics" published with Wentz, Everett and Grant. Orban's investigations, however, did not remain restricted to the tooth and its supporting tissues, but encompassed the pathology of the entire oral mucosa. The fruit of this work is the Atlas of Clinical Pathology of the Oral Mucous Membrane, published with Wentz, now in its second edition.

Twenty years ago Orban conceived the idea to pool knowledge and ideas of the teachers of oral histology and embryology to arrive at a text more nearly representative of this field. The result was a text on "Oral Histology and Embryology" that has gone through four editions since 1944. A new edition was already planned and, we hope, will prove that Orban's work will long survive him.

For his scientific work, Orban brought an unlimited curiosity and a keen sense of observation; for his clinical work a deep human understanding; for his teaching the enthusiasm of the true teacher that inspired his students to ever renewed efforts. And for all these three facets of his professional work, he had the unlimited patience so necessary for success, and the spirit of a fighter for truth. His work will live on, not only in his writings, but also in his pupils and friends who have inherited his passionate conviction that only in the wedding of basic knowledge and clinical techniques will rest true progress of that field that Orban has enriched so much. *H. Sicher*

Joseph P. Weinmann

1896-1960

Joseph Weinmann died on May 15th, two days after his sixty-fourth birthday. Weinmann was born in New Bistritz, in Czechoslovakia. As a student at the Medical School of the University of Vienna he entered, as many of the best students did, one of the basic science departments. He selected general pathology as his field and was Instructor in Bacteriology and Histopathology under Oskar Stoerk from 1921 to 1923. After graduating as an M.D. in 1923 he joined Gottlieb's group in the Dental Department where he worked as a Research Associate until he had to leave Austria in 1938. In Chicago he worked for one year at the University of Illinois, College of Dentistry, then for another year as Assistant Professor of Research at Columbia University with M. Diamond. Returning to Chicago he was appointed Assistant Professor for Oral Pathology at Loyola University Dental School. After six years he joined again the faculty of the University of Illinois, first as Associate Professor of Histology. In 1949 he was appointed Professor of Pathology and Chairman of the department at the dental college and Professor of Oral Pathology at the Medical College, positions he held to his death.

Weinmann was a fellow, diplomate and past president of the American Academy of Oral Pathology; fellow of the American Association for the Advancement of Science; member of the International Association for Dental Research; of the Chicago Society of Pathology; and of Sigma Xi honorary fraternity.

His association with Gottlieb, Orban, Stein and others led him into the field of Histology and Histopathology of the dental supporting tissues. The result of studies on the changes in the alveolar bone during mesial drift was a classic paper published in 1925 with Georg Stein. Weinmann's interest in bone physiology and pathology led to studies of eruption, of changes in renal hyperparathyroidism, traumatic injuries in the

jaws of infants. Further studies on bone biology finally stimulated the writing, with H. Sicher, of the book "Bone and Bones," now in its second edition.

In the field of Periodontology his early findings of altered metabolism in cases of Periodontosis have lasting value, as also his clarification of the spread of gingival inflammation along the neurovascular channels in the alveolar septa. His collaboration with Diamond resulted in a classic monograph on Amelogenesis. The discovery of two distinct phases in the histogenesis of enamel, namely enamel matrix formation and maturation, in turn was the basis of a differential diagnosis of hereditary enamel disturbances: Hypoplasia and Hypocalcification.

In his last years Weinmann was fascinated by the different behavior of skin and oral mucosa in carcinogenesis. A series of studies and papers, planned teamwork in his department, was the result, especially the examination of mitotic activity under different circumstances and of the processes of keratinization. With Julia Meyer, H. Medak, J. Henry and others such investigations were undertaken and have already brought fruit, e.g. the discovery of incomplete parakeratosis and incomplete orthokeratosis and the discovery of two different types of keratohyalin granules in different areas of the oral mucosa in the mouse.

More investigations were planned and are being followed by the members of his staff. Inspired by his leadership, shocked but undaunted by his death, his friends and pupils will keep his spirit alive, a welding of imagination and discipline, qualities that Weinmann, the scientist, shared with Weinmann, the artist. He had the imagination and vision to see questions and the discipline and perseverance to explore all avenues in pursuit of an answer.

H. Sicher

We have just been informed that Dr. Harold G. Ray of the University of California School of Dentistry, San Francisco, California, died in London on July 17. Details in next issue.

THE AMERICAN INSTITUTE OF ORAL BIOLOGY

The 17th Annual Meeting of the American Institute of Oral Biology will be held in Palm Springs, California, October 8 to 12, 1960, preceding the meeting of the American Dental Association in Los Angeles. The faculty will comprise the following outstanding speakers: Benjamin H. Ershoff, Ph.D., Director of the Western Biological Laboratories in Culver City, California; John Field, Ph.D., Associate Dean of the School of Medicine, University of California at Los Angeles; Edgar S. Gordon, M.D., Professor of Medicine, University of Wisconsin; Wilton M. Krogman, Ph.D.; C. M. Pomerat, M. D., Professor of Cytology at the University of Texas Medical Branch; Hamilton B. G. Robinson, D.D.S., M.S., Dean of the School of Dentistry, University of Kansas City, and Milton J. Schiffrin, Ph.D., Clinical Assistant Prof. in Anesthesiology at the University of Illinois.

Announcements . . . .

AMERICAN ACADEMY OF PERIODONTOLOGY

Annual Meeting, October 13, 14, 15, 1960

Theme of the Program:

The Role of the Tooth in Periodontal Health and Disease

THURSDAY, OCTOBER 13—A. M.

11:00-11:45—Report on the workshop for graduate and postgraduate teachers in periodontology
Perry A. Ratcliff, D.D.S., San Bernardino, California

11:45-12:00—Question and answers concerning the recommendations of the workshop

THURSDAY, OCTOBER 13—P. M.

2:00- 2:35—Anatomy and physiology of the tooth—soft tissue junction
Harry Sicher, M.D., D.Sc., Chicago, Illinois

2:35- 2:45—Discussion open to the floor

2:45- 5:00—Symposium on: The tooth as an etiologic factor in periodontal disease
Moderator: D. Walter Cohen, D.D.S., Philadelphia, Pennsylvania

The crown of the tooth as an etiologic factor
Russell C. Wheeler, D.D.S., St. Louis, Missouri

The root or roots as etiologic factors
C. H. M. Williams, D.D.S., Toronto, Ontario

The cementum: Its role in periodontal health and disease
Donald A. Kerr, D.D.S., M.S., Ann Arbor, Michigan

Relationship of the teeth to the gingiva, vestibule, muscle attachments, and bone in the etiology of periodontal disease
Saul Schluger, D.D.S., Seattle, Washington

Open discussion to the floor

FRIDAY, OCTOBER 14—A. M.

9:00- 9:40—Current concepts of calcification
W. D. Armstrong, M.D., Ph.D., Minneapolis, Minnesota

9:40- 9:50—Discussion
L. Sognnaes, D.M.D., Ph.D., Los Angeles, California

9:50-10:20—The oral enzyme systems and their relation to periodontal health and disease
Leo M. Sreebny, D.D.S., M.S., Ph.D., Seattle, Washington

10:20-10:30—Open discussion

10:30-12:00—Can calculus formation be prevented?
Moderator: B. O. A. Thomas, D.D.S., M.S., Ph.D., Palo Alto, California
By diet?
George W. Burnett, D.D.S., Ph.D., Washington, D.C.
By enzymes and antienzymes?
Robert G. Kesel, D.D.S., Chicago, Illinois
By chemicals other than enzymes?
Bruce Rice, D.D.S., M.Sc., Tucson, Arizona
By oral hygiene?
Frank E. Beube, D.D.S., New York, New York
Open discussion

FRIDAY, OCTOBER 14—P. M.

2:00- 2:30—Problems in the removal of calculus
Henry M. Goldman, D.M.D., Boston, Massachusetts

2:30- 3:00—Methods and values of tooth planing in periodontal therapy
Richard Chace, D.D.S., Orlando, Florida

3:00- 3:15—Open discussion of preceding papers

3:15- 3:45—Wound healing in periodontal surgery
Balint J. Orban, M.D., D.D.S.,* and Frank Wentz, D.D.S., Ph.D.

3:45- 5:00—Should the teeth be scaled prior to surgery?
Moderator: R. Earl Robinson, San Francisco, California
Members of panel: Irving Glickman, D.D.S., Boston, Massachusetts, C. M. Fraleigh, D.D.S., M.S.D., Morgantown, W. Va., Robert Gottsegen, D.D.S., New York, New York

SATURDAY, OCTOBER 15—A. M.

Accessory preventive and therapeutic procedures involving the crowns of teeth
Moderator: John McKenzie, D.D.S., Miami, Florida

9:00- 9:30—The individual dental restoration related to periodontal health and disease
Rex Ingraham, D.D.S., Los Angeles, California

9:30-10:00—Indications and principles for splinting of teeth
Daniel Feder, D.D.S., Beverly Hills, California

10:00-10:30—Grinding teeth for masticatory efficiency and gingival health
Sylvan S. Schireson, D.D.S., Beverly Hills, California

10:30-10:45—Discussion from the floor

10:45-11:15—Tongue habits and their correction
Robert E. Moyers, D.D.S., Ph.D., Ann Arbor, Michigan

11:15-11:20—Open discussion

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*Doctor Orban died June 1, 1960.

SATURDAY, OCTOBER 15—P. M.

CLINIC PROGRAM

John C. Grant, D.D.S.—Histology of Muco-Gingival Surgery.

Richard C. Oliver, D.D.S.—Pitfalls in X-ray Interpretation of Bony Lesions.

Vernon E. Hyde, D.D.S.—A Technique for Construction of Full-Mouth Gingival Stimulators.

R. Thomas Dunkin, D.D.S.—Repositioning and Splinting of Teeth as Adjunctive Procedures in Periodontal Therapy.

Robert Keefe, D.D.S.—Temporary Splints in Periodontal Therapy.

E. Earl Robinson, D.D.S.—Management of the Infra-Alveolar Pocket.

John D. Pingree, D.D.S.—Root Planing as Observed Through a Dissecting Microscope.

Robert L. Lang, D.D.S.—Fixed Splinting.

Thomas Holder, D.D.S.—A Case Report.

Grant Overby, D.D.S., Irving Stern, D.D.S., Jules Minker, D.D.S.—Splinting and Reconstruction Using the Screw and Sleeve Technique on Periodontally Involved Teeth.

Irving Stern, D.D.S.—The Electron Microscope and Periodontal Research.

Lowell H. Peterson, D.D.S.—Physiologic Repositioning of Periodontally Involved Teeth.

Harry Bohannan, D.D.S.—Evaluation of Procedures for the Deepening of the Vestibular Fornix.

UNIVERSITY OF WASHINGTON SCHOOL OF DENTISTRY

The University of Washington School of Dentistry will present a three-day course on "Management of Advanced Periodontal Disease" August 4, 5 and 6, 1960 with Dr. John F. Prichard, Dr. John I. Ingle and Dr. Saul Schluger as instructors.

This course has been designed to present details of modern concepts, methods and techniques pertaining to the management of advanced periodontal disease by means of surgical and prosthetic intervention. Clinical periodontal pathology and its effect upon the alveolar and supporting bone and management of the various deformities in bone will be reviewed and discussed. All methodology will be directed toward the maintenance of physiologic form or its recapture when the periodontium has been deformed by disease. The importance of occlusion in periodontal disease will be presented through discussions of the physiology of the masticatory system to include the roentgenographic and clinical phases of diagnosis of periodontal traumatism in addition to therapeutic procedures, including fixed and removable periodontal prosthesis.

For further information write Dr. Saul Schluger, Director, Graduate Dental Education and Professor, Periodontology, University of Washington School of Dentistry.

MIDWEST SOCIETY OF PERIODONTOLOGY

Officers for the Midwest Society of Periodontology. Seated left to right, Drs. Genevieve Roth, Member at Large, Erwin M. Schaffer, President, and Henry M. Swenson, President-Elect. Standing, Drs. Luke Howlett, Secretary, Jack C. Penticuff, Past President, M. W. Houglum, Treasurer, and Irving C. Stone, Member at Large.

The Midwest Society of Periodontology annual meeting was held at the Blackstone Hotel in Chicago on February 7, 1960. The scientific program was devoted to the relationship of occlusion to periodontal involvements. Eighty-two members and guests attended indicating a popular interest in this organization and the program.

UNIVERSITY OF PENNSYLVANIA

The University of Pennsylvania School of Dentistry announces that applications are requested for a Clinical Fellow in Oral Pathology supported by the American Cancer Society, tenable at the Department of Pathology, School of Dentistry, University of Pennsylvania, for a period of one year beginning July 1, 1960.

A stipend of $3600 (tax free) accompanies the fellowship.

Each candidate should submit a curriculum vitae and letters of reference to Dr. Charles E. Wilde, Jr., Ph.D., Department of Pathology, School of Dentistry, University of Pennsylvania, 4001 Spruce St., Philadelphia 4, Pennsylvania.

TUFTS UNIVERSITY SCHOOL OF DENTAL MEDICINE

Tufts University School of Dental Medicine will present "A Special Participation Course in Periodontology" (DPG 605) Monday through Friday for one week from October 31, 1960 through November 4, 1960. Tuition $175.00, class limited.

In this course emphasis is placed upon learning by clinical experience in addition to lectures and demonstrations. Half the time is devoted to clinical sessions in which each participant treats patients under Dr. Glickman's guidance. Bifurcation, involvement, infrabony pockets, the "unembellished gingivectomy" frenectomy and splinting are dealt with at the chairside. The "Bone Factor" concept for the diagnosis, determination of prognosis and treatment planning for individual teeth and the dentition as a functioning unit will be explained in detail.

For further information write Director of Division of Graduate and Postgraduate Studies, Tufts University School of Dental Medicine, 136 Harrison Avenue, Boston 11, Massachusetts.

Letters to the Editor . . . .

In the January 1960 issue of THE JOURNAL OF PERIODONTOLOGY, an article was published which, I believe, requires some detailed comment. The author of "Wire Ligature: An Undesirable Form of Temporary Splinting" states that "the purpose of this paper is to prove conclusively that wire ligature is undesirable and should not be used for stabilizing teeth." Progress is possible only when current practices are examined and re-evaluated and new ones substituted if they are found to be definitely superior. However, before a technique which has been valuable for many years is discarded, the evidence against it must be scientific and unassailable. It would be unfortunate if a useful technique were to be abandoned on the basis of unproved assumptions.

Dr. Saturen states that "teeth while 'stabilized' with wire ligature in accordance with accepted techniques of wiring will be extruded, intruded, will twist axially, will be malposed lingually or labially, will tip and buckle." While it is true that such things *can* happen, they rarely do if the ligature is placed properly. In our office, we have used several hundred ligatures, many of them remaining in place for several years for special reasons. Only a few have resulted in additional buckling (where the teeth had originally been crowded) and in such cases, other forms of support were used. Dr. Saturen renders a service in bringing up the fact that this can occur. But in the great majority of cases, no such changes were apparent. To confirm this impression, in several cases wired since the appearance of this article, the cuspid-to cuspid width was measured before ligation and found to be unchanged several weeks afterwards. It would have been reduced if there had been buckling.

Dr. Saturen mentions extrusion and depression as well. If the ligature is kept incisal to the cingulum of an extruded tooth (by a suspender wire in extreme cases), the tooth cannot extrude further. If there were any movement, it could only be depression, which would be beneficial.

Dr. Saturen wrote "as the wire ligature is worn by the patient, it is noted that further adjustment is needed, not because the wire stretches but because the teeth are moved together or buckled." In most properly made ligatures, it is necessary to tighten the interproximal wires only once, a week or so after placement, and then they will not require further tightening for many months, if at all. If this slack were due to movement of the teeth, it would occur again immediately after the first tightening. The fact that only one adjustment is usually required indicates that it is necessary to eliminate slight waviness and irregularities present in the ligature. A straight line is the shortest distance between two points and elimination of the irregularities provides slack which must be corrected.

If a ligature is constructed with the arch wires joined at the ends at once and the indentations in the arch wire made arbitrarily before the interproximal wires are placed and tightened, the shifts described by Dr. Saturen may occur, since the ligature will determine the position of the teeth. It is very difficult to achieve good adaptation of the wire to the teeth in the manner. However, if the arch wires are carefully adapted to the first tooth of the group being ligated (which can be done best if the arch wires are not joined until the very end of the ligature) and the first interproximal wire is tightened almost completely before the arch wires are adapted to the second tooth, the ligature is adapted to the present positions of the teeth rather than vice-versa. Since the wire is adapted and tightened one tooth at a time, each tooth is held in its position. The use of .008-inch rather than .010-inch wires for interproximal wires will also reduce any likelihood of crowded teeth being wedged apart. Dr. Saturen writes "Tension represents an active principle of movement and is obviously a disadvantage where immobilization—(stabilization, lack of movement)—is being sought. . . ." "Recognizing that the use of wire ligature involves active tooth movement, . . . etc." If care is taken in the amount of twisting wires, a properly adjusted ligature is firm but with minimal tension, just as is a cast steel splint. Any tension present causes an insignificant movement of the teeth in being dissipated.

Dr. Saturen concludes by saying that ligatures should be discarded because there are better methods available, but doesn't mention what they are. All other methods of stabilization that I know of, even though they may be indicated under certain special circumstances, have inherent disadvantages. Orthodontic band splints are unesthetic and require considerable space between the teeth for thicknesses of band material, ruling them out for crowded teeth. Removable splints are bulky and require patient cooperation, which may not always be adequate. Their support is often not as firm as is required. Ligatures painted with acrylic, if left in place for some time will often result in decalcification of the enamel underneath. Sectional lingual arches, while providing good support are rather bulky on the lingual side and may interfere with the tongue. Acrylic splints in undercut grooves in the lingual surfaces of the teeth often leak and become loose as a result of dimensional changes in the acrylic. They also commit the patient to further restorations because of the cuts made in the teeth.

I believe that, considering the disadvantages of these methods and the fact that properly made ligatures do not have any of these disadvantages, ligatures are a valuable method of temporary stabilization. Most deleterious changes resulting from their use can be prevented by correct application and close observation.

LEONARD HIRSCHFELD,
730 Fifth Avenue, New York 19, N. Y.

Dear Sir:

Dentistry has just lost a great scientist. Humanity has lost a great man. This loss is a personal one—my dearest and closest friend in 30 years of professional life.

Balint Orban gave to many people who studied with him, not only an understanding of his research but also something which only a few great teachers can impart—a philosophy, which to many professional men has meant a better way of life. Through his great and unselfish efforts, dentistry has made terrific strides in his field; and through personal association at his Seminars, men have been inspired to much greater heights. We have enough pleasant memories of the times we have had together to fill the rest of our lives; however, his last years were not filled with happiness—a thing which many of us could not understand.

It is just possible that some help may come from the Italian poet, Salvatore Quasimodo, Nobel Prize winner. I quote:

> "Man keeps striving to realize his internal needs, and the external organization imposed by an ideology will never be enough for his purposes. But this external force and this internal need—this conflict—exist.
>
> The history of man is a slow progress from his savagery. And the battle of the true man of culture in this progress has become a terrible one. For, increasingly, as he works for civilization, society refuses to recognize him. He ends by being trampled under the very forces he creates.
>
> The middle class is guilty of grave wrongs in this conflict. At the end of the 19th century it was the middle class that fought for cultural liberty. At that time the middle class contained within itself all the men of culture—artists, poets, mathematicians—all the intelligentsia. But when it had achieved its freedom it began to think it could do without the intelligentsia. This is the decadence of the European middle class."

To a great man dentistry owes a debt which cannot be measured at this early date; and to those of us who were privileged to know him well, a debt which cannot be measured, ever.

Harold E. Grupe, D.D.S.

Dental Services,
Fort Dix, New Jersey.